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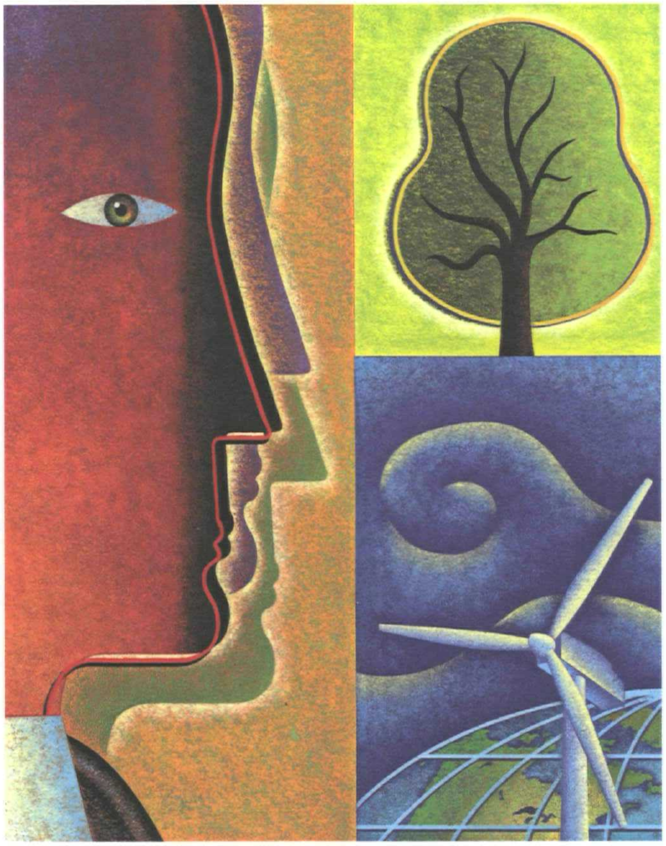
Monitored Natural Attenuation Engineering Demonstration Project

Summary Report

Lemberger Landfill and Lemberger Transport and Recycling Site
Franklin Township, Manitowoc County, Wisconsin

December 2008



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Prepared for
Lemberger Site Remediation Group

RMT, Inc. | Lemberger Site Remediation Group
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Executive Summary

In April 2006, the Lemberger Site Remediation Group (LSRG) obtained approval from the United States Environmental Protection Agency (USEPA) to begin a monitored natural attenuation (MNA) demonstration project at the Lemberger Landfill, Inc. (LL), and the Lemberger Transport & Recycling, Inc. (LTR), Superfund Sites. The intent of the 2-year project was to evaluate the effectiveness of MNA as an appropriate long-term remedial alternative for the plume of chlorinated volatile organic compounds (CVOCs) that is associated with the LTR. Thorough analysis of the MNA data confirms that the processes of biotic and abiotic degradation of CVOCs and the physical mechanisms of dispersion and diffusion are actively degrading the residual mass of dissolved CVOCs in groundwater and effectively attenuating the plume.

As the first step in the MNA demonstration project, the groundwater pump-and-treat system was shut down on August 1, 2006. Eight quarterly groundwater sampling events were performed as part of the 2-year demonstration project, the first of which was completed in September 2006. Groundwater samples were collected from each of the site's 51 groundwater monitoring wells for laboratory analysis of 13 MNA parameters and 61 volatile organic compounds (VOCs). Samples of groundwater were also collected from 23 residential water supply wells near the LL and LTR quarterly and semiannually, according to the USEPA-approved (pre-MNA demonstration project) sampling schedule.

The groundwater elevations and flow directions during the demonstration project were consistent with the elevations and flow directions that were observed when the groundwater pump-and-treat system was operational. The post-shutdown orientation of the plume of CVOCs did not change during the demonstration project, and statistical analysis of the post-shutdown CVOC data confirmed that there are stable or decreasing trends at sentinel wells. The concentration of the CVOC parent compounds 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE) remained stable or decreased during the project, and VOCs were not detected in the residential water supply wells.

Natural attenuation of the groundwater plume is occurring at the sites as the result of the degradation of CVOCs that is driven by biotically mediated reductive dechlorination, and aerobic oxidation and co-metabolism, and as a result of the physical mechanisms of dilution, dispersion, and diffusion. Reductive dechlorination is primarily evident in the LTR wells (source area bedrock wells), where the concentrations of the CVOC breakdown products 1,1-dichloroethane (1,1-DCA) and cis-1,2-dichloroethene (cis-1,2-DCE) are increasing as the concentrations of parent compounds 1,1,1-TCA and TCE are stable or are decreasing. The absence of ethene, the absence of vinyl chloride and chloroethane outside of the source area, and the occurrence of elevated carbon dioxide (CO_2) at the source areas and throughout the plume indicate that aerobic oxidation of vinyl chloride and cis-1,2-DCE is actively taking place. In addition, the mixing of the dissolved CVOCs along the groundwater flow path and the diffusion of the contaminant mass into and out of the rock matrix are important attenuating factors. The decreasing concentrations of CVOCs and the stable plume margins that have been evident over time are the result of the cumulative effects of these natural attenuation processes.

The analysis of MNA parameter data suggests that reductive dechlorination of CVOCs is occurring in anaerobic micro-environments within the bedrock, while aerobic degradation is simultaneously occurring throughout the plume. Consistent with reductive dechlorination, dissolved oxygen (DO) is lower beneath the LTR than in the surrounding bedrock and is depleted within the distal plume. Nitrate is also depleted beneath the LTR and is coincident with detections of vinyl chloride and chloroethane. Total inorganic carbon (TIC) and chloride are also elevated beneath the LTR and in near-field bedrock wells. And, as noted above, CO_2 is elevated beneath the LTR and throughout the groundwater plume coincident with an absence of ethene, all of which is consistent with aerobic degradation of vinyl chloride; cis-1,2-DCE; 1,1-DCA; and 1,1-DCE.

An exception to the overall decreasing trends in parent compound concentrations at the site is the increasing concentration trends for 1,1,1-TCA and TCE at RM-7XD. To better define the vertical and lateral extent of this deeper portion of the plume, two deep monitoring wells, RM-7XXD and RM-208XD, were installed in September 2008. The results of the field investigation confirmed that the concentrations of 1,1,1-TCA and TCE in groundwater decrease vertically below the LTR and decrease laterally downgradient of the LTR. Reductive dechlorination in the deeper bedrock is also evident in the detection of chloroethane in groundwater below RM-7XD and the increasing ratio of cis-1,2-DCE relative to TCE laterally in the deeper bedrock between borehole RM-7XXD (2:1) and borehole RM-208XD (4:1). Most importantly, the depth of the plume fringe (190 feet) does not extend to the minimum casing depth requirement (250 feet) for newly constructed residential wells. These new data suggest that nearby drinking water supplies are not at an increased risk.

Overall, the results of the MNA demonstration project indicate that natural attenuation of the plume of CVOCs is occurring via multiple processes and at a sufficient rate to contain and degrade the CVOC plume. The shutdown of the pump-and-treat system did not result in measurable changes to the plume, as is confirmed by statistical analysis of the post-shutdown CVOC data. The installation of deep monitoring wells verified that residential wells constructed according to the local casing requirement are not at increased risk. Most importantly, analysis of the MNA data, the historical CVOC analytical data, and the historical pump-and-treat operational data (lack of mass recovery via pump-and-treat) indicates that the historical decreasing trends in parent compounds with coincident increasing trends in daughter compounds are the result of the processes of MNA more so than the result of active pump-and-treat. The evaluation of the data, therefore, indicates that the project was successful in demonstrating MNA as a viable long-term remedial alternative.

Section 1
Introduction

RMT, Inc. (RMT), on behalf of the Lemberger Site Remediation Group (LSRG), is submitting this Monitored Natural Attenuation Demonstration Project Summary Report (the Report). This Report is the final summary of the 2-year demonstration project which was presented in the April 2006 revised Workplan for the MNA Engineering Demonstration Project (MNA Workplan) (RMT, 2006c). The USEPA approved the MNA Workplan on June 15, 2006.

Section 2
Sampling Schedule

The approved schedule of groundwater sampling that was performed during the MNA demonstration project was presented in the MNA Workplan (RMT, 2006c). The sections that follow summarize that sampling schedule and present any modifications that were made to it.

2.1 Schedule of Sampling According to the Workplan

Samples from the site's 51 groundwater monitoring wells were field- and/or laboratory-analyzed for 22 geochemical parameters (MNA parameters) over the 2-year MNA demonstration period. Table 1 presents the schedule of quarterly and semiannual MNA groundwater monitoring that was performed. Table 2 lists the MNA parameters, analytical methods, and reporting limits; and Table 3 lists the types of sample containers, preservatives, and holding times. Figure 1 shows the locations of all groundwater monitoring points utilized in the demonstration project.

2.2 Sampling Events This Period

During this final reporting period, samples of groundwater were collected in March/April 2008 (seventh round) and in July 2008 (eighth round). Groundwater samples were also collected from residential wells near the LL and LTR in March and June 2008.

2.3 Sampling Methods

Samples of groundwater were collected using low–flow rate techniques as described in the Quality Assurance Project Plan (QAPP) Addendum (RMT, 2006a), and samples were field- and laboratory-analyzed in accordance with the Supplement to the Addendum to the QAPP (RMT, 2006b). Changes to the sampling methods are described in the following Sections.

2.3.1 Dissolved Oxygen

Beginning with the fourth quarterly sampling event in July/August 2007, CHEMets® (self-filling reagent ampoules) were used to field-analyze the concentration of DO in groundwater in addition to the use of dissolved oxygen (DO) probes. Geotech® P3 probes are used during the low-flow stabilization of each well to monitor DO and other stabilization criteria (pH, temperature, specific conductance, and oxidation reduction potential [ORP]), per the QAPP, but at the time of sampling, a CHEMets® ampoule is also used to measure the concentration of DO. The result of the CHEMets® ampoule method was compared with the DO probe reading, as a quality control check. During this final reporting period, the reported DO results for the ampoule method generally matched the probe readings as they did previously in the fourth, fifth, and sixth sampling rounds. Subsection 4.5 contains a discussion of the DO results.

2.3.2 Residential Well Sample Preservation

In March 2007 (during the third quarterly sampling round), false-positive detections of chloromethane were reported at three residential wells, likely due to the chemical reaction of the groundwater samples with the hydrochloric acid with which the samples are preserved. This chemical reaction was mentioned in the United States Geological Survey (USGS) Open File Report 97-829 (1998). To avoid the false-positive results, the residential well samples were collected in unpreserved vials, beginning with the fifth round of MNA sampling. The WDNR approved of this change in sampling protocol with a letter to RMT dated September 10, 2007. As a result of the use of nonpreserved sample containers, chloromethane has not been detected in the residential well samples.

Section 3
Deep Monitoring Well Installation

Two new deep (bedrock) groundwater monitoring wells, RM-7XXD and RM-208XD, were installed at the sites in September 2008 to further investigate the vertical extent of the CVOC plume. The work was performed according to the December 2007 Supplemental Workplan for Deep Monitoring Well Installation (Deep Well Workplan) (RMT, 2007) which was subsequently approved by USEPA and the WDNR with a letter dated July 28, 2008. A letter summarizing the well installation process and presenting the results of groundwater sampling performed during the well installation process was submitted to the USEPA on December 12, 2008 and is contained in Appendix A of this report.

The results of the groundwater sampling that was performed during the September 2008 well drilling process, and an evaluation of the rock cores that were retrieved, confirm the following:

- Dense nonaqueous-phase liquids (DNAPL) were not encountered in deep bedrock near the LTR.
- Bedrock that was encountered at depths below 100 feet below ground surface (bgs) is fossiliferous dolomite that contains micro-fractures developed along stylolitic sutures, and horizontal fractures with small openings (generally < 1 mm to 5 mm openings). Few horizontal fractures have openings larger than 10 mm. Rock quality designations were typically 95 percent or greater.
- Vertical fractures in dolomite were encountered at RM-208XD, at depths between approximately 104 and 114 feet bgs.
- The CVOC plume extends to a depth of approximately 190 feet below the LTR, which is above the minimum casing requirement for new residential wells (250 feet below ground surface).
- The concentrations of 1,1,1-trichloroethane (1,1,1,-TCA) and trichloroethene (TCE) decrease with depth beneath the LTR.
- The concentrations of CVOCs decrease laterally between RM-7XXD and RM-208XD.
- The ratio of cis-1,2-DCE relative to TCE increases with distance laterally between the 139- to 144-foot packer test interval at borehole RM-7XXD (2:1) and the 128-to 133-foot interval at borehole RM-208XD (4:1), and chlorothane is present in the 139- to 144-foot packer test interval at borehole RM-7XXD.
- Wells RM-7XXD and RM-208XD are appropriately placed as deep sentinel wells that will be useful for monitoring any deeper migration of the plume over time.

Section 4
Monitored Natural Attenuation

The focus of the MNA demonstration project and this Report is to incorporate the geochemical parameter data (MNA parameter data) with the CVOC analytical data, to determine whether or not MNA is an effective remedial option. The primary and secondary lines of evidence that will support an MNA remedy for the site's CVOC plume are presented and discussed below. The orientation of the plume of CVOCs is illustrated, and a summary of the site's hydrogeology is presented. The trends in the reduction of 1,1,1-TCA and TCE and the production of 1,1-DCA; cis-1,2-DCE; chloroethane; and vinyl chloride are evaluated. The geochemical footprints of the CVOC plume, as evident in the distribution of MNA parameters, are also presented and discussed.

Natural attenuation of the site's CVOC plume can be documented through analysis of the physical, biological, and chemical processes that act on it. Degradation of the chlorinated compounds of concern (1,1,1-TCA, TCE, and their respective breakdown compounds) can occur via the following mechanisms:

- Biotically-mediated reductive dechlorination
- Biologically-mediated aerobic oxidation and aerobic co-metabolism
- Abiotic hydrolosis and elimination

And, mechanical attenuation (dilution) of the groundwater plume can also occur via the following mechanisms:

- Dispersion (mixing)
- Diffusion

The site data suggest that all of the above processes are likely affecting the groundwater plume.

4.1 Plume Orientation

The plume of CVOCs that is associated with the LTR is oriented along the primary directions of groundwater flow. Figures 2 through Figure 5 illustrate the orientation of the groundwater plume and show the isoconcentrations of 1,1,1-TCA (Figure 2), 1,1-DCA (Figure 3), TCE (Figure 4), and cis-1,2-DCE (Figure 5) detected in bedrock wells in July 2008. The plume orientation and groundwater flow directions have not changed as a result of the shutdown of the pump-and-treat system, and the plume margins are stable. Supporting statistical analysis of the post-shutdown data is presented in Subsection 4.6 of this Report. The historical orientations of the plume are depicted on the isoconcentration maps contained in the MNA Status Reports and in various other historical reports.

4.1.1 Groundwater Flow Directions

Three distinct saturated units underlie the LTR and LL sites—a perched water table occurs in a sandy upper granular unit (UGU) that overlies a clay-confining unit (CU); a saturated lower granular (sand and gravel) unit (LGU) that, in the western and northwestern portion of the site, is confined by the CU above and clay/layers of clay below; and the underlying dolomite bedrock (Niagaran Formation) that crops out southeast of the site. The water table occurs in bedrock beneath the LTR and LL. Beginning at a distance approximately 0.2 mile northwest of the LTR and beneath the western edge of the LL, the water table occurs in the LGU. The LGU and bedrock are therefore hydraulically connected, and in the northwestern portion of the site, where the LGU overlies bedrock, the groundwater flow directions in the LGU and bedrock units converge and both units discharge to the Branch River.

Figure 6 shows the potentiometric surface of the bedrock aquifer for July 2008. Water elevations from water table wells completed in bedrock and from piezometers completed in bedrock below the LGU are contoured. The northwesterly direction of groundwater flow in bedrock near the LTR is consistent with the slope of the bedrock surface and the predominant orientation of fractures (RMT, 2007). Where the LGU overlies bedrock, the direction of groundwater flow in the bedrock is more northerly than northwesterly and is convergent with the LGU flow direction.

Figure B-1, contained in Appendix B, shows the LGU potentiometric surface and flow directions for July 2008. The water elevations for the shallow wells completed in the LGU are contoured. Groundwater in the LGU flows northeast and north toward discharge at the Branch River.

Figure 7 shows the elevation and flow direction of the perched water table in the UGU for July 2008. The flow direction is westerly, consistent with past observations. Groundwater in the upper granular unit (UGU) is not hydraulically connected to the LGU and bedrock unit from which groundwater was extracted prior to August 1, 2006.

Figure 8 and Figure 9 are geologic cross sections that illustrate the subsurface geology along a section roughly parallel to the groundwater flow direction (Figure 8, Section A-A') and along a section roughly perpendicular to the groundwater flow direction (Figure 9, Section B-B'). The cross sections show various monitoring wells, extraction wells, residential wells, the groundwater potentiometric surface contours, CVOC analytical results, and the extent of the groundwater plume. A cross section locator is found in the lower left-hand corner of the figures. The CVOC results shown on the figures are discussed in Subsections 4.2 and 4.6.

4.1.2 Variations in Groundwater Elevations and Flow Directions

Appendix C contains hydrographs for each well, which show that the post-shutdown water elevations and the seasonal variations in water elevations are consistent with the historical data, and as depicted on the various potentiometric contour maps (that have been presented in the preceding MNA Status Reports), the post-shutdown groundwater flow directions are also consistent with the historical flow directions. Table 4 presents a summary of the groundwater elevations measured at the site since July 5, 2006. A tabular summary of water level measurements, which includes water level data for months not coincident with the quarterly sampling events, is contained in the routine O&M Progress Reports. As shown on the hydrographs, the seasonal "high water" elevations occur in spring, while the seasonal "low water" elevations occur in winter.

4.1.3 Vertical Hydraulic Gradients

The hydrographs contained in Appendix C also identify the direction of vertical hydraulic gradients between nested wells. The vertical gradients at the sites are not strong, but are consistent. At the LTR source area, nested bedrock wells RM-7D/XD typically have a flat to slightly downward gradient. At well nest RM-3I/3D (northwest of RM-7D/XD) and at RM-5I/D, upward gradients from the bedrock to the LGU are constant. Where the LGU is underlain by clay, (and heads in the LGU are higher), downward gradients occur from the LGU to bedrock (at RM-202I/D and RM-2I/D), although at RM-212I/D, downward gradients typically occur only during recharge in winter and spring. At well nest RM-210I/D, a constant upward gradient from bedrock to the LGU is indicative of the well's location near the discharge point to the Branch River. Table 5 presents the calculated vertical hydraulic gradients for the sites' nested wells on July 3, 2008. The previous MNA Status Reports and O&M Progress Reports contain the vertical gradient tables that were prepared for previous months/years.

4.2 Reductive Dechlorination

Figure 10 and Figure 11 show the common degradation pathways for chlorinated ethanes and ethenes. These diagrams, as well as other research, show that biotically-mediated reductive dechlorination is the only significant pathway that will generate cis-1,2-DCE from TCE, and 1,1,-DCA from 1,1,1-TCA. The wide distribution of cis-1,2-DCE and 1,1-DCA in the groundwater plume, combined with the ratios of parent product to breakdown product, is clear and convincing evidence that biologically-mediated reductive dechlorination is an ongoing and active process in the CVOC plume.

The primary lines of evidence that support reductive dechlorination are the biotically-mediated reduction of parent compounds with a coincident production of breakdown compounds. A summary of the VOC analytical data supporting reductive dechlorination of the CVOC plume follows:

- The concentration of 1,1-DCA is increasing at LTR source area (bedrock) wells RM-7D, RM-209D, RM-306D, and RM-307D, while the concentration of 1,1,1-TCA is decreasing or is stable (no trend at RM-7D).
- The concentration of cis-1,2-DCE is increasing at LTR source area (bedrock) wells RM-7D, RM-303D, and RM-307D, while the concentration of TCE is decreasing or is stable (no trend at RM-7D).
- Chloroethane has been detected at RM-7D, RM-7XD, and RM-303D. Chloroethane was also detected in the 139- to 144-foot interval in boring RM-7XXD at a concentration greater than at RM-7XD. Chloroethane is the biotic reductive dechlorination product of 1,1-DCA.
- Vinyl chloride has been detected at RM-7D and RM-214D. Vinyl chloride is the biotic reductive dechlorination product of cis-1,2-DCE.
- The large ratio of cis-1,2-DCE relative to trans-1,2-DCE suggests that most of the cis-1,2-DCE in groundwater results from biologically mediated degradation of TCE. Biologically produced dichloroethane is nearly 100% cis-1,2-DCE (Waterloo Educational Services, 2000).
- The ratio of cis-1,2-DCE relative to TCE increases with distance laterally between the 139- to 144-foot packer test interval at borehole RM-7XXD (2:1) and the 128- to 133-foot interval at borehole RM-208XD (4:1), showing that reductive dechlorination is occurring in the plume downgradient of the LTR.
- The concentration of parent compounds is decreasing at all site wells, with the exception of RM-7XD; but reductive dechlorination is evident at RM-7XD, in that cis-1,2-DCE is being produced at a rate faster than the increase in TCE and because chloroethane is present.

Appendix D provides a tabular summary of all VOCs detected in groundwater during the demonstration project, and Table 6 provides a summary of the VOCs detected at concentrations greater than Chapter NR 140 Enforcement Standards. Appendix E contains the trend plots showing all of the CVOC analytical data results (including all historical results). Further discussion of the CVOC analytical trends is found in Subsection 4.6 of this Report.

4.3 Aerobic and Abiotic Degradation

The processes of aerobic oxidation and co-metabolism are also active components of the degradation pathway. As is shown on Figures 10 and 11, oxidation and co-metabolism of the breakdown products of TCE (cis-1,2-DCE and vinyl chloride) can occur in an aerobic environment; and, the breakdown products of 1,1,1-TCA can also undergo oxidation (1,1-dichloroethene) and co-metabolism (1,1-DCA). The resulting accumulation of carbon dioxide (CO_2) and the absence of chloroethane, vinyl chloride, and ethene are indicative of aerobic degradation. Therefore, identifying the patterns of aerobic degradation is equally as important as identifying evidence of reductive dechlorination.

A summary of evidence supporting aerobic co-metabolism and oxidation of the CVOC plume follows:

- CO_2 is detected at elevated concentrations in groundwater at the source area, the near-source area, and throughout the CVOC plume, consistent with aerobic respiration.
- CO_2 is not likely produced as the result of reductive dechlorination of vinyl chloride because ethene is not detected in groundwater.
- The presence of CO_2 can therefore be attributed to oxidation of vinyl chloride; cis-1,2-DCE; and 1,1-DCE, as well as co-metabolism of 1,1-DCA. Some CO_2 production might also be attributed to aerobic degradation of other organic acids.
- The absence of vinyl chloride in the downgradient plume and the correlation of detectable concentrations of vinyl chloride near the source area with the absence of ethene and with the areas of most elevated CO_2 suggest that elevated CO_2 throughout the plume is more likely the result of continual oxidation and co-metabolism than it is a shadow of the production of CO_2 at the source area.

The process of abiotic elimination of 1,1,1-TCA has also resulted in minor production of 1,1-dichloroethene (1,1-DCE) in groundwater at the sites. Aerobic oxidation of 1,1-DCE is possible and also results in the production of CO_2. Reductive dechlorination of 1,1-DCE would result in the production of vinyl chloride.

Table D1, contained in Appendix D, provides a tabular summary of the MNA analytical results for the demonstration project. A discussion of the MNA parameter results is found in Subsection 4.5 of this Report.

4.4 Mechanical Attenuation – Dispersion and Diffusion

Attenuation via dispersion (mixing) of the plume occurs predictably along the groundwater flow paths, such that CVOC concentrations in the lateral edges and downgradient portion of the plume diminish with increasing distance from the source. The orientation of the shallow downgradient portion of the plume is controlled by the effects of dispersion in the LGU. As suggested by the site's conceptual model, the portion of the plume within the bedrock has developed as it would in a porous media. Fracture flow has not resulted in the migration of CVOCs through preferential pathways. Attenuation of contaminant mass via diffusion of CVOCs from bedrock fractures to the porous bedrock matrix, as described in the Bedrock Investigation Report (RMT, 2007), is likely to result in a slow release of CVOCs back to the groundwater.

Dispersion at the edges of the groundwater plume is also an important attenuating factor. As shown on Figure A-1 (Appendix A), the flux of "clean," upgradient water in the LGU (which encounters the CVOC plume approximately 0.2 mile northwest of the LTR) mixes with the western flank of the plume, and orients the resultant plume dimension in a north-south direction. As a result, the CVOC plume does not threaten shallow wells located northwest of the LTR. Dispersion at the plume fringes (both horizontally and vertically) in both the bedrock and LGU also provides oxygen-rich recharge that is an important factor for aerobic degradation of CVOCs, as was noted above.

4.5 Monitored Natural Attenuation (MNA) Parameters

The processes of reductive dechlorination and aerobic degradation (oxidation and co-metabolism) of CVOCs appear to be occurring simultaneously within the plume. Analysis of the distribution of MNA parameters in groundwater identified several geochemical footprints that are expected with both biotic and abiotic degradation processes and suggest that anaerobic environments are present within the otherwise aerobic bedrock/LGU aquifer. These footprints provide the secondary lines of evidence supportive of the patterns of reductive dechlorination and aerobic degradation that are evident in the CVOC analytical data.

The patterns of distribution of MNA parameters that were consistently evident in groundwater at the sites during the demonstration project are further described in the following Sections and are briefly summarized as follows:

- **TIC** concentrations are greater than background at LTR source area (bedrock) wells and at near-field bedrock wells immediately downgradient of the LTR.
- **CO_2** concentrations are greater than background at LTR source area (bedrock) wells, near-field bedrock wells, and along the full length of the CVOC plume.
- **DO** concentrations are lower at LTR source area (bedrock) wells as compared to the surrounding near-field bedrock wells; and DO is possibly depleted in the bedrock aquifer along the full length of the CVOC plume.
- **Nitrate** is depleted at LTR source area (bedrock) wells.

- **Chloride** concentrations are twice the background concentrations at LTR source area (bedrock) wells and near-field bedrock wells.

4.5.1 Discussion of Individual MNA Parameter Results

Predictable patterns/changes in the oxidative state of the geochemical parameters (MNA parameters) in groundwater can be expected with both reductive dechlorination and aerobic oxidation and co-metabolism.

The following patterns in MNA parameter distributions are expected with reductive dechlorination (WDNR, 2003):

- Presence of total organic carbon (TOC)
- Increases in the concentrations of total inorganic carbon (TIC) and carbon dioxide (CO_2) relative to background
- Depletion of dissolved oxygen (DO)
- Depletion of nitrate (NO_3-)
- Increase in the concentration of manganese (Mn^{2+}) relative to background
- Increase in the concentration of ferrous iron (Fe^{2+}) relative to background
- Decrease in the concentration of sulfate (SO_4-) relative to background
- Increase in the concentration of chloride (twice the background concentration)
- Presence of ethane and ethene

And, aerobic co-metabolism and oxidation can result in the following MNA parameter distributions:

- Increase in the concentration of CO_2 relative to background
- Absence of vinyl chloride, chloroethane, ethene, and ethane
- Presence of oxygen/inability of reductive dechlorination to proceed to anaerobic conditions

A parameter-by-parameter discussion of the inorganic MNA parameter results is developed below. Appendix D presents a tabulated summary of the field- and laboratory-analyzed MNA parameters. Several figures that further illustrate the spatial distribution of individual MNA parameters in the LGU and bedrock unit are also presented.

Total Organic Carbon

TOC is not typically detected in the LGU or bedrock unit, except at LTR source area (bedrock) wells RM-7D and RM-303D; near-field bedrock wells RM-307D, RM-213D, RM-214D; and at far-field bedrock wells RM-4D and RM-2D. The range of TOC detections for these wells is 1.2 mg/L (at RM-214D, October 2006) to 8.6 mg/L (at RM-213D, September 2006). TOC is, however, routinely detected at slightly higher concentrations in wells that monitor the perched groundwater at the LL. The carbon source at the LL and near the LTR may be related to releases from the landfill and from the plume itself. A natural source of TOC in groundwater is not apparently available or has been depleted.

Total Inorganic Carbon

Carbon compounds that are termed "inorganic carbon" include H_2CO_3, $CaCO_3$, and CO_2. Despite the apparent lack of organic carbon, the CO_2, alkalinity, and TIC concentrations suggest that microbial activity is consuming the only available source of carbon in groundwater (e.g., that source being the LTR source area and the core of the plume of CVOCs). Of these parameters, TIC is perhaps the most accurate indicator of carbon dioxide production related to microbial activity (WDNR, 2003). Figure 12 shows the distribution of TIC in the LGU and bedrock wells. Increased concentrations of TIC relative to background are consistently detected at RM-209D, RM-303D, RM-213D and RM-214D. Figure 13 shows the distribution of CO_2 in the LGU and bedrock, and isoconcentration contours are shown for CO_2 detected in bedrock wells. The highest concentration of CO_2 in groundwater occurs at RM-214D and RM-303D, but CO_2 is also elevated along the entire length of the CVOC plume. The distribution of alkalinity (not shown on figure) is comparable to that of CO_2.

Dissolved Oxygen

The concentration of DO at the LTR source area (bedrock) wells is significantly lower than at the surrounding near-field bedrock wells (i.e., <2 mg/L at RM-7D, RM-209D, and RM-303D compared to >5 mg/L at RM-306D, RM-307D, RM-308D, RM-213D, and RM-8D, in July 2008). DO is sometimes depleted (<0.5 mg/L) at near-field bedrock well RM-214D and may be depleted within the core of the CVOC plume that extends north; however, most of the plume would be considered as aerobic (e.g. DO >0.5 µg/L). Figure 14 shows the distribution of DO in the LGU and bedrock wells, and iso-concentration contours are shown for DO in the bedrock wells.

DO is also depleted in the LGU and bedrock in the western portion of the site. The presence of clay-confining layers (CU above and clay below the LGU) in this portion of the site might explain the low DO concentrations. Where the LGU is in direct contact with bedrock, the concentrations of DO in the bedrock wells is not depleted (i.e., DO ranges from 1.25 mg/L at RM-211D to 3.99 mg/L at RM-101D). When compared to these latter well locations, the DO in bedrock wells within or near the downgradient portion of the plume appears to be depleted relative to DO at other bedrock wells.

Nitrate

The concentration of nitrate is depleted (<1 mg/L) at RM-7D and RM-7XD. Nitrate is also lower at RM-214D as compared to other bedrock wells where the LGU is in contact with bedrock. Where the LGU is confined by clay, the concentrations of nitrate are also depleted, suggesting that agricultural inputs of nitrogen (such as fertilizer applications and manure spreading) have not penetrated the CU. In addition, where nitrate is depleted or lower than background, the most reduced chlorinated compounds (e.g., chloroethane and vinyl chloride) are detected.

Manganese

The concentrations of manganese in the LGU and bedrock wells are variable, perhaps due to natural causes. The highest concentrations of manganese are consistently detected at RM-214D, RM-2D, RM-210D, and RM-4D. Trends in the manganese concentrations are not evident in the data; therefore, manganese is not a reliable constituent for future MNA monitoring at the sites.

Ferrous Iron

Ferrous iron is detected in very few LGU and bedrock wells; and where it is detected, the concentrations are generally less than 2 mg/L. Wells with iron detections include RM-4D, RM-10D, RM-201I, RM-201D, RM-202I, RM-202D, RM-205I, RM-205D, RM-213D, and RM-214D. The highest concentration of ferrous iron detected in the LGU or bedrock was at RM-205D (2.2 mg/L) in September 2006. The variability of ferrous iron concentrations does not appear to be a reliable indicator for future MNA monitoring at the sites.

Sulfate

Sulfate is present in groundwater at concentrations greater than background at near-field LTR and LL wells. The detected sulfate is likely related to landfill wastes, and trends in sulfate related to reductive dechlorination are not readily apparent. Therefore, sulfate is not a reliable indicator for future MNA monitoring.

Chloride

Chloride is detected in groundwater at concentrations generally greater than twice the background concentration at LTR source area (bedrock) wells and near-field bedrock wells. However, chloride may be the result of applications of road salt or may be from releases from the landfill or other sources and should not be relied upon too heavily to support the breakdown of CVOCs.

Ethane and Ethene

Ethane and ethene have not been detected in groundwater at the site's monitoring wells. This is not unexpected, since chloroethane and vinyl chloride are likely being degraded aerobically.

Methane

Methane has not been detected in the LGU or bedrock wells, except at RM-7D (86 μg/L), in July 2007. That result was not verified with detections in subsequent sampling events. Methane does not appear to be a useful parameter for MNA monitoring for the LTR plume. A lack of methane within the plume is not unexpected since methanogenic conditions are not required for the reductive dechlorination of TCE or 1,1,1-TCA.

4.6 CVOC Analytical Results – Trend Analysis

The CVOC analytical data were subjected to a statistical analysis (Sens's Slope analysis) to quantitatively distinguish increasing and/or decreasing trends from data for which no trend can be established. The analysis were performed on two segments of data for each well with detected CVOCs—the entire historical data set, and the eight rounds of data collected for the MNA demonstration project. Appendix E contains the trend plots showing all of the CVOC analytical data results (including all historical results). Appendix F contains a table presenting a summary of the trend analysis, and the results of the statistical computations. The results of the statistical analysis support the evidence for biotic and abiotic degradation of CVOCs that was described above.

The historical data set indicates that parent compound (1,1,1-TCA and TCE) concentrations are decreasing at all wells, with the exception of at RM-7XD. Increasing trends for breakdown compounds (1,1,1-DCA and/or total-1,2-DCE) are noted at LTR source area (bedrock) wells RM-7D, RM-7XD, RM-209D, RM-306D, and RM-307D. Decreasing or stable concentrations (no trend) were indicated for 1,1-DCA and total-1,2-DCE at all other wells. (Also note that the increasing trends noted for 1,1,1-TCA and 1,1,-DCA at RM-4D and for total-1,2-DCE at RM-208I and RM-203I are not significant because the data set includes results that are either nondetect or near or below laboratory detection limits.)

Statistical evidence of increasing trends in the detected concentrations of CVOCs in the post-shutdown data (past eight rounds) was not found. Decreasing trends in the post-shutdown data were identified at a few wells, consistent with the overall historical decreasing trends. No trend in the post-shutdown data was evident for the majority of wells.

4.6.1 Sentinel Wells

Per the USEPA's request (memorandum from Richard Boice to Kris Krause, dated October 9, 2008), the Upper Confidence Limits (UCLs) for the sentinel wells were revised for this Report. Rather than using the entire historical data set for each individual well and parameter through the July 2006 baseline sampling event, the UCLs were recalculated to include only the results since roughly 2001 (approximately the last 10 to 20 sampling events, depending on the individual well). The revision of the UCLs resulted in a lower UCL for each sentinel well. For data sets consisting of 100% nondetect results, no upper limit was calculated and the Limit of Quantitation (LOQ) is used as the background limit. Appendix G contains the trend plots showing the historical concentrations of CVOCs and the revised UCLs for each sentinel well.

With the exception of sentinel well RM-211D, CVOCs were either detected at concentrations below each sentinel well's respective 95% UCL, or were not detected at concentrations above the laboratory Limit of Detection (LOD), during the demonstration project. At RM-211D, the recent detections of 1,1,1-TCA exceed the revised UCL of 2.6 μg/L; however, the PAL for 1,1,1,-TCA is 40 μg/L. The detections of 1,1,1-TCA at RM-211D are not a significant occurrence because the detections are at very low levels and because the revised UCL (which, as a result is quite low) is significantly below the PAL. However, this trend will be monitored as sampling continues at RM-211D.

4.6.2 Residential Wells

CVOCs were not detected in the residential wells during this final reporting period nor were they detected during any of the eight previous quarterly monitoring events. Appendix D contains the laboratory analytical results for the residential well samples.

Table 9 provides a summary of the well construction information for the residential wells that are sampled as part of the currently approved monitoring program. Figure 15 shows the private well locations, casing depth, and total well depth. Appendix H contains the residential well construction records that were obtained via a search of the WDNR records of Well Constructor's Reports and well construction information kept by the Wisconsin Geological and Natural History Survey. The well records were matched as best as possible to addresses, owners' names, and with local knowledge; but the information has not been verified beyond those means. Residential well construction logs could not be found and/or matched to the following wells: GR-13, GR-15, GR-16, GR-25, GR-27, GR-33, and GR-41. Four of those wells (GR-13, GR-15, GR-16, and GR-27) are downgradient of the LTR.

The combination of the residential well VOC analytical results, the historical CVOC analytical results (for groundwater monitoring wells), and the September 2008 deep monitoring well analytical results suggests that the casing requirement (250 feet of casing) is sufficient to protect drinking water supplies for any new residential construction.

4.7 Summary

Together, the CVOC and MNA analytical data confirm that the processes of reductive dechlorination, aerobic degradation, and physical attenuation of CVOCs are taking place at the site. Reductive dechlorination is likely occurring in anaerobic microcosms, while aerobic degradation is occurring in the rest of the otherwise aerobic aquifer system. The primary evidence of reductive dechlorination is found in the production of breakdown compounds 1,1-DCA and cis-1,2-DCE at the LTR source area (bedrock) wells, while the concentrations of parent compounds 1,1,1-TCA and TCE are decreasing or are stable. Strong positive correlations are also evident between the distribution of MNA parameters that would be expected with reductive dechlorination and the distribution and increase in concentration of CVOC degradation compounds throughout the plume. Aerobic co-metabolism and oxidation are also evident in both the CVOC chemistry and MNA parameter results.

The following examples of the relationships between the CVOC analytical data and MNA parameter data are confirming evidence of reductive dechlorination and aerobic degradation of CVOCs at the site:

- DO is lower, nitrate is depleted, TIC and CO_2 are elevated, and chloride is elevated compared to background, where 1,1-DCA and cis-1,2-DCE are being produced at the LTR source area (bedrock), all of which support reductive dechlorination.
- Where chloroethane and vinyl chloride are produced (in the source area bedrock), DO is also lower and/or depleted, nitrate is depleted, manganese is possibly elevated, and CO_2 is most elevated, again supporting the process of reductive dechlorinaion.
- The presence of CO_2 is likely attributed to oxidation and/or co-metabolism of vinyl chloride, 1,1-DCA, and 1,1-DCE, because ethene is absent.
- DO is possibly depleted and CO_2 elevated throughout the distal portion of the plume, which suggests that microbial activity (related to reductive dechlorination and/or oxidation and cometabolism) is occurring (or has occurred) outside of the source area.

Section 5
Conclusions and Recommendations

After thorough analysis of the groundwater analytical data that were collected over the 2-year demonstration period, and in consideration of the significant historical site investigation, remediation, and monitoring data, we have concluded that MNA is a viable remedial alternative for the site. Active degradation of the CVOC plume via reductive dechlorination and aerobic degradation, along with mechanical attenuation, will continue to reduce the concentrations of CVOCs in groundwater and maintain the current levels of protectiveness of human health (drinking water supplies) and the environment.

5.1 Conclusions

The results of this MNA demonstration project confirm that reductive dechlorination and aerobic degradation are actively reducing concentrations of CVOCs in groundwater at the sites, and that natural processes are capable of maintaining active degradation of the residual CVOCs. Support for this conclusion is found in the MNA data itself, in the historical CVOC groundwater analytical data, in the significant site investigation and modeling efforts that were performed to develop an understanding of the fate and transport of the CVOC plume, and in the data obtained from years of performing the pump-and-treat remedy.

The following conclusions can be drawn from the above data set in support of MNA as the appropriate remedy:

- Modeling results and influent data have suggested that the pump-and-treat remedy was ineffective in removing a significant contaminant mass and provided limited containment (RMT, 2004).
- Shutdown of the pump-and-treat system has not resulted in changes in groundwater elevations or flow patterns, nor has it resulted in migration of the CVOC plume.
- Reductive dechlorination, aerobic oxidation, and co-metabolism are acting simultaneously in the aquifer to degrade the CVOC plume.
- Statistical analysis of the historical CVOC analytical data confirms that parent compound (1,1,1-TCA and TCE) concentrations are decreasing at all wells, with the exception of RM-7XD; and breakdown compound (1,1,1-DCA and cis-1,2-DCE) concentrations are increasing at LTR source area (bedrock) wells.
- Statistical evidence of increasing trends in the detected concentrations of CVOCs in the post-shutdown data (past eight rounds) was not found.

- The historical trends in CVOC concentrations are the result of natural processes of attenuation, including reductive dechlorination, rather than the result of mass reduction or containment attributable to operation of the pump-and-treat remedy.
- The addition of deep wells RM-7XXD and RM-208XD confirmed that dissolved CVOCs decrease in concentration vertically to below detection limits at a depth approximately 190 feet below the LTR and confirmed that CVOCs decrease in concentration with increased lateral distance from the LTR.
- The depth of the plume is above the casing requirement depth for new residential wells (250 feet) and does not pose an additional threat to residential wells.
- Reductive dechlorination is occurring in the bedrock beneath the LTR and downgradient of the LTR, as evident in the presence of breakdown compounds (e.g., chloroethane) in the borehole for RM-7XXD and in the increasing ratio of cis-1,2-DCE relative to TCE between boreholes RM-7XXD and RM-208XD.
- Residual dense nonaqueous-phase liquids (DNAPL) are not evident beneath the LTR; residual contaminant mass has diffused into the bedrock matrix in the dissolved phase and will slowly release back to groundwater and attenuate.

5.2 Long-Term MNA Sampling Schedule

The LSRG submits the following Long-Term MNA Sampling Program to accommodate future amendment of the ROD. Table 10 presents the proposed Long-Term MNA Sampling Program. Refer to Figure 1 for the well locations. The proposed Long-Term MNA Monitoring Program is recommended to be implemented upon completion of and EPA approval of the results of the LL Leachate Head Study. Until that time, the Interim Groundwater Monitoring Program, which was approved by the USEPA and WDNR on December 17, 2008, will be implemented.

Changes to the Long-Term MNA Sampling Program relative to the Interim Groundwater Sampling Program include the following:

- Wells RM-205I, RM-205D, RM-201I, RM-201D, RM-202I and RM-202D will not be sampled, because CVOCs have not been detected at these wells (not detected in sampling between 1996 and the present), and they are located upgradient and/or sidegradient relative to the plume.
- Once the LL Leachate Head Study has been completed, many of the MNA parameters (e.g., alkalinity, manganese, sulfate, etc.) are not anticipated to provide useful information in monitoring the effectiveness of the remedy. Sixteen MNA parameters are proposed be field and/or laboratory analyzed, as compared to the 22 MNA parameters that were field and/or laboratory analyzed as part of the MNA Engineering Demonstration Project. The reduced list of parameters is sufficient to monitor the geochemical footprints related to the specific

mechanisms of reductive dechlorination and aerobic degradation that are on-going at the site.

When performing the Interim and/or Long-Term Groundwater Monitoring Programs, the LSRG will routinely evaluate and optimize the sampling with respect to the well network, frequency of sampling and sampling parameters, and annually report findings, conclusions and recommendations to the USEPA.

Section 6
References

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Table 1
Approved Groundwater Monitoring Program for MNA Demonstration Project - Revised Sampling Schedule (Project Years 1 and 2)
Lemberger Sites

WELL GROUP	PROJECT YEAR 1												PROJECT YEAR 2											
	MONTH NUMBER												MONTH NUMBER											
	1	2 (Sep)	3	4	5 (Dec)	6	7	8 (Mar)	9	10	11 (Jun)	12	1	2 (Sep)	3	4	5 (Dec)	6	7	8 (Mar)	9	10	11 (Jun)	12
IA		V&M (MNA)			V&M (MNA)			V&M (MNA)			V&M (MNA)			V&M (MNA)			V&M (MNA)			V&M (MNA)			V&M (MNA)	
IB (Note 1)		V&M (MNA)			V&M (MNA)			V&M (MNA)			V&M S/P/C (MNA)			V&M (MNA)			V&M (MNA)			V&M (MNA)			V&M S/P/C (MNA)	
IIA		V&M (MNA)						V&M (MNA)						V&M (MNA)						V&M (MNA)				
IIB (Note 2)		V&M (MNA)			(V)			V&M (MNA)			(V) S/P/C			V&M (MNA)			(V)			V&M (MNA)			(V) S/P/C	
IIIA											V&M (MNA)												V&M (MNA)	
IIIB (Note 2)		(V)			(V)			(V)			V&M S/P/C (MNA)			(V)			(V)			(V)			V&M S/P/C (MNA)	
IV											(V) (MNA)												(V) (MNA)	
Metals Background Well (Note 3)																								
Residential Group I		V			V			V			V			V			V			V			V	
Residential Group II		(V)			V			(V)			(V)						V						(V)	

Abbreviations:

V&M = volatile organic compounds and metals.
S/P/C = semivolatile organic compounds, pesticides/PCBs, and cyanide.
MNA = monitored natural attenuation parameters.
V = volatile organic compounds only.

Notes:

1. Sampling of extraction wells is not included; however, groundwater elevation will be measured at each extraction well during each monitoring round.
2. Groundwater collection (GWC) sumps, including EW-6S, will not be sampled.
3. This well (RM-9D) was abandoned during the bedrock investigation drilling program in summer 2005.
4. Abbreviations shown in **bold** font in parentheses are analyses added to the currently approved monitoring program, for the MNA demonstration project. Abbreviations in nonbold font without parentheses are analyses required by the currently approved monitoring program.
5. The two monitoring wells that were constructed in September 2005 as part of the LTR bedrock investigation (RM-213D and RM-214D) will be sampled with Well Group IA.

Table 2
Monitored Natural Attenuation Parameters, Analytical Methods, and Reporting Limits

GROUNDWATER PARAMETER	FIELD OR LABORATORY	METHOD	EQUIPMENT	LIMIT OF DETECTION (LOD)	LIMIT OF QUANTITATION (LOQ)
Alkalinity (total)	Field	Hach kit	Hach kit	10 mg/L as $CaCO_3$ (4)	N/A
Carbon dioxide	Field	Hach kit	Hack kit	1.25 mg/L	25 mg/L
Dissolved oxygen	Field	360.1 (1)	Probe	0.1 mg/L (5)	N/A
Iron (II)	Field	8146 WAH	Hach kit	0.1 mg/L	N/A
Oxidation reduction potential	Field	Standard methods (2)	Electrode	N/A	N/A
pH	Field	150.1 (1)	Electrode	N/A	0.1 standard units
Specific conductivity	Field	120.1 (1)	Electrical conductivity meter	N/A	1 μmhos/cm
Temperature	Field	--	Probe	N/A	0.1°C
Turbidity	Field	SM 2130B	Meter	NA	1 NTU
Alkalinity (total)	Laboratory	2320B (2)	Per method	3.7 mg/L	10 mg/L
Chloride	Laboratory	300.0 (1)	Per method	0.88 mg/L	5.0 mg/L
Ethane	Laboratory	M8015B (3)	Per method	1.6 μg/L	10 μg/L
Ethene	Laboratory	M8015B (3)	Per method	1.4 mg/L	10 mg/L
Manganese	Laboratory	6020 (3)	Per method	0.4 μg/L	2.0 μg/L
Methane	Laboratory	M8015B (3)	Per method	2 μg/L	10 μg/L
Nitrate	Laboratory	300.0 (1)	Per method	0.078 mg/L	0.40 mg/L
Nitrite	Laboratory	300.0	Per method	0.46 mg/L	0.10 mg/L
pH	Laboratory	150.1 (1)	Electrode	N/A	0.1 standard units
Sulfate	Laboratory	300.0 (1)	Per method	0.83 mg/L	4.0 mg/L
Temperature	Laboratory	--	Thermometer	N/A	0.1°C
Total inorganic carbon	Laboratory	415.2 (1)	Per method	0.80 mg/L	2.0 mg/L

Table 2 (continued)
Monitored Natural Attenuation Parameters, Analytical Methods, and Reporting Limits

GROUNDWATER PARAMETER	FIELD OR LABORATORY	METHOD	EQUIPMENT	LIMIT OF DETECTION (LOD)	LIMIT OF QUANTITATION (LOQ)
Total organic carbon	Laboratory	415.2[(1)]	Per method	0.80 mg/L	2.0 mg/L

Notes:
(1) USEPA 600/4-79-020, Methods for Chemical Analysis of Water and Waste.
(2) Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995.
(3) SW-846, Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, USEPA, 3rd Edition, 1986.
(4) Based on Hach Method 8203 digital titration.
(5) Based on typical field meter and dissolved oxygen probe with a resolution of 0.01 mg/L and used under normal field operating conditions.

N/A = not applicable.

Table 3
Water Sample Containers, Preservatives, and Holding Times for Monitored Natural Attenuation Parameters

PARAMETER	CONTAINER	MINIMUM SAMPLE VOLUME	FIELD PRESERVATION METHOD	HOLDING TIME[1]
Alkalinity, sulfate	One 250-mL high-density polyethylene bottle[3]	120 mL	Cool to 4°C	14 days (alkalinity) 28 days (sulfate)
Methane, ethane, and ethene	Three 40-mL VOA vials with Teflon® septum[2]	One x 40-mL VOA vial	Cool to 4°C, and add HCl to pH < 2; protect from light	7 days if unpreserved; 14 days if preserved (sample should remain on-site less than 24 hours)
Nitrate+nitrite nitrogen	One 250-mL high-density polyethylene bottle[3]	75 mL	Cool to 4°C, and add H_2SO_4 to pH < 2	28 days
Temperature, E_H, pH, specific conductivity, dissolved oxygen, ferrous iron, ORP, alkalinity (field)	--	--	--	Immediately after sample collection
Manganese	One 250-mL high-density polyethylene bottle[3]	50 mL	Cool to 4°C, and add HNO_3 to pH < 2	6 months
Total organic carbon, total inorganic carbon	Two 60-mL glass bottles	Bottles must be filled	Cool to 4°C, no headspace; add H_2SO_4 to pH < 2	28 days

Notes:
(1) Starting from time of sample collection.
(2) Collect three extra containers for MS/MSD samples.
(3) Collect one extra container for sample spike and duplicate analyses.

Table 4
Summary of Groundwater Elevations
July 2006 - January 2008
MNA Demonstration Study

	PRE-SHUTDOWN	POST-SHUTDOWN							
WELL	7/5/2006	9/8/2006	12/6/2006	4/6/2007	7/18/2007	9/13/2007	12/18/2007	4/28/2008	7/3/2008
OW-101A	806.28	805.27	804.57	807.09	805.52	804.88	803.71	807.93	808.09
OW-101B	806.24	805.22	804.54	807.03	805.51	804.87	803.67	807.90	808.04
OW-102A	802.54	802.67	802.13	803.54	803.04	802.49	801.43	804.17	804.56
OW-102B	802.60	802.63	802.06	803.45	803.04	802.45	801.38	804.07	804.49
OW-102C	802.70	802.76	802.17	803.58	803.09	802.62	801.47	804.21	804.62
OW-102D	802.74	802.73	802.17	803.57	803.09	802.52	801.48	804.21	804.59
OW-103A	793.69	794.58	794.30	795.07	794.84	794.47	793.57	794.91	795.68
OW-103B	793.62	794.29	794.03	794.81	794.56	794.21	793.34	794.68	795.46
OW-104A	791.28	791.56	791.36	791.72	791.36	791.24	790.91	791.87	791.76
OW-104B	791.12	791.54	791.34	791.71	791.34	791.17	790.88	791.83	791.65
OW-104C	791.25	791.52	791.31	791.68	791.31	791.19	790.90	791.86	791.75
OW-104D	791.23	791.51	791.27	791.66	791.31	791.16	790.85	791.81	791.69
OW-104E	791.24	791.53	791.32	791.69	791.33	791.20	790.89	791.82	791.73
OW-104F	791.33	791.56	791.37	791.77	791.39	791.25	790.92	791.91	791.82
OW-104G	791.23	791.49	791.27	791.66	791.30	791.18	790.82	791.83	791.66
OW-104H	792.07	792.36	792.13	792.61	792.28	792.08	791.65	792.81	792.88
OW-105A	805.33	804.50	803.86	805.68	804.78	804.25	803.06	806.66	806.64
OW-105B	805.31	804.40	803.79	805.52	804.75	804.19	802.99	806.59	806.64
OW-106A	828.38	826.42	826.57	830.41	826.76	826.06	825.81	830.11	828.94
OW-106B	828.78	826.92	827.11	831.90	827.25	826.89	826.86	830.71	829.30
RM-001D	790.93	791.18	790.92	791.32	790.83	790.71	790.40	791.34	791.26
RM-001I	791.20	791.36	790.80	791.26	790.78	790.69	790.36	791.32	793.75
RM-002D	791.89	792.12	791.93	792.51	791.95	791.80	791.48	793.63	792.42
RM-002I	794.88	795.22	794.91	795.61	795.16	794.91	794.20	796.19	795.96
RM-003D	802.06	801.91	801.41	802.41	802.27	801.81	800.50	802.99	803.56
RM-003I	801.31	801.37	801.09	801.85	801.60	801.17	800.08	802.36	802.87
RM-004D	801.13	801.34	801.31	808.96	801.45	800.61	799.44	804.87	802.81
RM-004S	841.73	840.64	840.42	842.19	839.39	838.30	837.07	841.36	841.52
RM-005D	800.16	800.46	799.93	800.83	800.57	800.03	799.09	801.09	801.84
RM-005I	800.05	800.30	799.80	800.65	800.51	799.88	799.03	800.98	801.68
RM-005S	836.65	835.63	836.54	838.38	835.53	834.55	834.13	838.06	836.84
RM-007D	807.09	805.32	804.71	807.30	805.66	805.24	803.70	808.02	808.93

Table 4 (continued)
Summary of Groundwater Elevations
July 2006 - January 2008
MNA Demonstration Study

WELL	PRE-SHUTDOWN	POST-SHUTDOWN							
	7/5/2006	9/8/2006	12/6/2006	4/6/2007	7/18/2007	9/13/2007	12/18/2007	4/28/2008	7/3/2008
RM-007S	838.49	837.58	839.41	840.67	837.93	837.15	836.57	840.41	838.99
RM-007XD	806.87	805.43	804.61	807.07	805.63	804.87	803.63	807.97	808.24
RM-008D	807.46	805.99	805.12	807.01	806.23	805.78	804.50	808.21	808.35
RM-010D	794.44	794.90	794.63	795.57	794.44	793.81	793.94	795.29	796.23
RM-011D	843.64	845.41	848.67	844.94	842.33	842.14	836.62	845.04	844.85
RM-101D	805.70	804.91	803.99	805.91	805.19	804.29	803.30	806.82	807.23
RM-101I	805.82	805.03	804.11	806.03	805.31	804.41	803.42	806.94	807.35
RM-102D	845.12	838.68	832.45	841.07	835.26	832.73	829.00	845.13	844.44
RM-103D	800.17	800.17	799.74	800.51	800.27	799.96	798.86	799.74	801.58
RM-103S	842.14	840.20	840.08	844.68	839.96	839.06	837.84	844.84	843.89
RM-201D	805.56	804.69	803.99	805.98	804.76	804.36	803.33	806.80	807.12
RM-201I	805.57	804.69	803.99	805.97	804.79	804.40	803.31	806.81	807.09
RM-202D	803.20	802.69	802.15	803.91	802.72	802.45	801.09	805.47	804.67
RM-202I	803.10	802.74	802.21	803.95	802.79	802.43	801.36	805.50	804.71
RM-203D	790.86	791.25	790.89	791.66	791.03	790.77	790.43	791.40	791.34
RM-203I	792.19	792.40	792.42	792.68	792.23	792.17	791.76	792.87	792.60
RM-205D	805.81	804.98	804.03	805.98	804.83	804.33	803.28	806.56	807.20
RM-205I	805.75	804.92	803.97	805.92	804.77	804.27	803.22	806.50	807.14
RM-206S	834.00	833.34	834.65	835.89	833.41	832.39	832.47	835.64	834.20
RM-207S	830.66	829.52	831.06	833.84	829.74	829.41	825.85	833.23	831.03
RM-208D	800.50	800.70	800.19	801.21	800.89	800.42	799.46	801.49	802.26
RM-208I	800.65	800.85	800.31	801.36	801.04	800.57	799.61	801.64	802.41
RM-208S	826.89	825.74	826.86	829.75	825.53	825.08	824.64	829.20	826.55
RM-209D	807.16	805.51	803.94	807.73	805.72	805.17	803.92	808.43	808.31
RM-210D	795.42	795.76	795.61	796.12	796.10	795.66	794.94	796.15	796.85
RM-210I	794.77	795.01	794.89	795.42	795.33	794.95	794.34	795.37	796.25
RM-211D	802.57	802.77	802.23	803.68	803.11	802.59	801.51	804.39	804.56
RM-212D	805.09	803.44	803.74	805.56	803.57	800.73	802.78	806.42	806.51
RM-212I	805.20	803.40	805.41	808.82	804.31	801.10	803.03	808.90	806.28
RM-213D	NM	804.78	803.56	806.05	805.52	804.42	803.15	807.07	807.23
RM-214D	NM	805.06	804.28	806.00	805.84	804.69	803.41	806.67	807.15
RM-301S	849.68	847.22	848.17	853.73	847.24	845.78	844.64	853.65	850.89

Table 4 (continued)
Summary of Groundwater Elevations
July 2006 - January 2008
MNA Demonstration Study

	PRE-SHUTDOWN	POST-SHUTDOWN							
WELL	7/5/2006	9/8/2006	12/6/2006	4/6/2007	7/18/2007	9/13/2007	12/18/2007	4/28/2008	7/3/2008
RM-302S	849.30	849.06	851.38	852.15	848.38	847.93	848.20	850.19	850.19
RM-303D	807.35	805.85	805.63	807.71	806.64	805.28	803.94	809.77	808.94
RM-304D	848.47	843.15	839.61	851.02	844.31	841.65	836.67	852.02	849.48
RM-305D	814.13	810.12	808.01	811.87	809.68	808.19	806.24	813.95	814.75
RM-306D	813.13	808.59	806.77	812.49	808.08	807.28	805.35	813.74	813.33
RM-307D	807.19	805.36	804.77	807.58	805.59	804.96	803.72	808.78	808.72
RM-308D	814.27	809.29	807.13	813.60	808.53	807.61	805.60	814.73	814.86

Notes:

NM = not measured.

Table 5
Vertical Hydraulic Gradients on July 3, 2008
Lemberger Landfill and Lemberger Transport and Recycling Site
Town of Franklin, Wisconsin

WELL	SCREEN FORMATION	GROUNDWATER ELEVATION (h) ft	REFERENCE ELEVATION (L) ft	DELTA h (ft)	DELTA L (ft.)	VERTICAL GRADIENT (i)	DIRECTION OF GRADIENT
OW-104A OW-104B	LGU Rock/LGU	791.76 791.65	785.40 771.00	0.11	14.40	0.008	Down
OW-104B OW-104F	Rock/LGU Rock	791.65 791.82	771.00 756.00	-0.17	15.00	-0.011	Up
RM-001I RM-001D	LGU? Rock	793.75 791.26	775.50 762.80	2.49	12.70	0.196	Down
RM-002I RM-002D	LGU? Rock	795.96 792.42	766.00 737.10	3.54	28.90	0.122	Down
RM-003I RM-003D	LGU LGU?	802.87 803.56	784.90 756.70	-0.69	28.20	-0.024	Up
RM-005I RM-005D	LGU Rock	801.68 801.84	797.10 754.60	-0.16	42.50	-0.004	Up
RM-007D RM-007XD	Rock Rock	808.93 808.24	802.30 742.50	0.69	59.80	0.012	Down
RM-101I RM-101D	LGU Rock	807.35 807.23	782.80 762.90	0.12	19.90	0.006	Down
RM-201I RM-201D	LGU Rock	807.09 807.12	763.90 750.10	-0.03	13.80	-0.002	Up
RM-202I RM-202D	LGU? Rock	804.71 804.67	776.60 759.20	0.04	17.40	0.002	Down
RM-203I RM-203D	LGU? Rock	792.60 791.34	789.70 768.90	1.26	20.80	0.061	Down
RM-205I RM-205D	LGU? Rock	807.14 807.20	771.20 751.10	-0.06	20.10	-0.003	Up
RM-208I RM-208D	LGU? Rock	802.41 802.26	794.70 777.90	0.15	16.80	0.009	Down
RM-210I RM-210D	LGU? Rock	796.25 796.85	793.00 766.90	-0.60	26.10	-0.023	Up
RM-212I RM-212D	LGU LGU	806.28 806.51	779.90 760.10	-0.23	19.8	-0.012	Up

Notes:
Vertical Gradient (i) = Delta h / Delta L; positive values indicate a downward hydraulic gradient.
Reference Point (L) for head measurements (h) is the water table for wells screened in the UGU, and the mid-point of the screened interval, including the sand filter pack, for piezometers.
Delta h = the distance between head measurements.
Delta L = the distance between reference points.
UGU = upper granular unit (perched aquifer).
LGU = lower granular unit.
Rock = bedrock and lower granular unit.
A gradient approaching 1 is indicative of the gradient between the perched aquifer and the bedrock aquifer.

Prepared by: T. Clausen 10/22/08
Checked by: C. Shaw, 12/6/08

Table 6
Summary of Volatile Organic Groundwater Standard Exceedences at Plume Monitoring Wells
Lemberger Landfill Sites
February 2008 - July 2008

WELL ID	DATE	PARAMETER	RESULT (µg/L)	DATA QUALIFIERS	STANDARD[1] (µg/L)		EXCEEDENCE
					ES[2]	PAL[3]	
RM-003D	7/15/08	1,1,1-TRICHLOROETHANE	56.2		200	40	PAL
RM-003D	4/22/08	1,1-DICHLOROETHENE	2.6		7	0.7	PAL
RM-003D	7/15/08	1,1-DICHLOROETHENE	4.8		7	0.7	PAL
RM-003D	7/15/08	CIS-1,2-DICHLOROETHENE	9.7		70	7	PAL
RM-003D	4/22/08	TRICHLOROETHENE	3.1		5	0.5	PAL
RM-003D	7/15/08	TRICHLOROETHENE	4.3		5	0.5	PAL
RM-005D	4/21/08	1,1-DICHLOROETHENE	3.2		7	0.7	PAL
RM-005D	7/18/08	1,1-DICHLOROETHENE	3.4		7	0.7	PAL
RM-005D	4/21/08	CIS-1,2-DICHLOROETHENE	8.4		70	7	PAL
RM-005D	7/18/08	CIS-1,2-DICHLOROETHENE	9.9		70	7	PAL
RM-005D	4/21/08	TRICHLOROETHENE	3		5	0.5	PAL
RM-005D	7/18/08	TRICHLOROETHENE	3.8		5	0.5	PAL
RM-005I	4/21/08	1,1-DICHLOROETHENE	1.3	J	7	0.7	PAL
RM-005I	7/18/08	1,1-DICHLOROETHENE	1.1	J	7	0.7	PAL
RM-005I	4/21/08	TRICHLOROETHENE	1.3	J	5	0.5	PAL
RM-005I	7/18/08	TRICHLOROETHENE	1.5	J	5	0.5	PAL
RM-005I DUP	4/21/08	1,1-DICHLOROETHENE	1	J	7	0.7	PAL
RM-005I DUP	4/21/08	TRICHLOROETHENE	1.5	J	5	0.5	PAL
RM-005S	4/21/08	TRICHLOROETHENE	1.3	J	5	0.5	PAL
RM-005S	7/18/08	TRICHLOROETHENE	2.2		5	0.5	PAL
RM-007D	4/17/08	1,1,1-TRICHLOROETHANE	903		200	40	ES
RM-007D	7/17/08	1,1,1-TRICHLOROETHANE	576		200	40	ES
RM-007D	4/17/08	1,1-DICHLOROETHANE	593		850	85	PAL
RM-007D	7/17/08	1,1-DICHLOROETHANE	424		850	85	PAL
RM-007D	4/17/08	1,1-DICHLOROETHENE	65		7	0.7	ES
RM-007D	7/17/08	1,1-DICHLOROETHENE	44.2		7	0.7	ES
RM-007D	4/17/08	CIS-1,2-DICHLOROETHENE	222		70	7	ES

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Table 6 (continued)
Summary of Volatile Organic Groundwater Standard Exceedences at Plume Monitoring Wells
Lemberger Landfill Sites
February 2008 - July 2008

WELL ID	DATE	PARAMETER	RESULT (µg/L)	DATA QUALIFIERS	STANDARD(1) (µg/L)		EXCEEDENCE
					ES(2)	PAL(3)	
RM-007D	7/17/08	CIS-1,2-DICHLOROETHENE	138		70	7	ES
RM-007D	4/17/08	TRICHLOROETHENE	50.2		5	0.5	ES
RM-007D	7/17/08	TRICHLOROETHENE	36.6		5	0.5	ES
RM-007D	7/17/08	VINYL CHLORIDE	2	J	0.2	0.02	ES
RM-007D DUP	7/17/08	1,1,1-TRICHLOROETHANE	575		200	40	ES
RM-007D DUP	7/17/08	1,1-DICHLOROETHANE	420		850	85	PAL
RM-007D DUP	7/17/08	1,1-DICHLOROETHENE	42.4		7	0.7	ES
RM-007D DUP	7/17/08	CIS-1,2-DICHLOROETHENE	137		70	7	ES
RM-007D DUP	7/17/08	TRICHLOROETHENE	37.8		5	0.5	ES
RM-007XD	4/17/08	1,1,1-TRICHLOROETHANE	181		200	40	PAL
RM-007XD	7/17/08	1,1,1-TRICHLOROETHANE	137		200	40	PAL
RM-007XD	4/17/08	1,1-DICHLOROETHANE	108		850	85	PAL
RM-007XD	7/17/08	1,1-DICHLOROETHANE	93		850	85	PAL
RM-007XD	4/17/08	1,1-DICHLOROETHENE	37.1		7	0.7	ES
RM-007XD	7/17/08	1,1-DICHLOROETHENE	33.9		7	0.7	ES
RM-007XD	7/17/08	CARBON TETRACHLORIDE	1.3	J	5	0.5	PAL
RM-007XD	4/17/08	CIS-1,2-DICHLOROETHENE	135		70	7	ES
RM-007XD	7/17/08	CIS-1,2-DICHLOROETHENE	124		70	7	ES
RM-007XD	4/17/08	TRICHLOROETHENE	36.5		5	0.5	ES
RM-007XD	7/17/08	TRICHLOROETHENE	34.3		5	0.5	ES
RM-008D	3/13/08	1,1,1-TRICHLOROETHANE	62.7		200	40	PAL
RM-008D	3/13/08	1,1-DICHLOROETHENE	3.4		7	0.7	PAL
RM-008D	3/13/08	CIS-1,2-DICHLOROETHENE	13.4		70	7	PAL
RM-008D	3/13/08	TRICHLOROETHENE	4.4		5	0.5	PAL
RM-008D	7/15/08	TRICHLOROETHENE	1.3	J	5	0.5	PAL
RM-008D DUP	7/15/08	1,1,1-TRICHLOROETHANE	48.6		200	40	PAL
RM-008D DUP	7/15/08	1,1-DICHLOROETHENE	2.4		7	0.7	PAL

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Table 6 (continued)
Summary of Volatile Organic Groundwater Standard Exceedences at
Plume Monitoring Wells
Lemberger Landfill Sites
February 2008 - July 2008

WELL ID	DATE	PARAMETER	RESULT (μg/L)	DATA QUALIFIERS	STANDARD[1] (μg/L)		EXCEEDENCE
					ES[2]	PAL[3]	
RM-008D DUP	7/15/08	CIS-1,2-DICHLOROETHENE	8.7		70	7	PAL
RM-008D DUP	7/15/08	TRICHLOROETHENE	3.8		5	0.5	PAL
RM-101D	3/16/08	TRICHLOROETHENE	1.1		5	0.5	PAL
RM-103D	4/7/08	1,1-DICHLOROETHENE	1.3	J	7	0.7	PAL
RM-103D	7/18/08	1,1-DICHLOROETHENE	0.96	J	7	0.7	PAL
RM-103D	4/7/08	TRICHLOROETHENE	1.5	J	5	0.5	PAL
RM-103D	7/18/08	TRICHLOROETHENE	1.4	J	5	0.5	PAL
RM-103S	4/7/08	CIS-1,2-DICHLOROETHENE	9.9		70	7	PAL
RM-103S	4/7/08	TRICHLOROETHENE	1.2	J	5	0.5	PAL
RM-103S	7/18/08	TRICHLOROETHENE	0.88	J	5	0.5	PAL
RM-103S	4/7/08	VINYL CHLORIDE	2		0.2	0.02	ES
RM-203D	3/17/08	TRICHLOROETHENE	0.58	J	5	0.5	PAL
RM-203D	7/7/08	TRICHLOROETHENE	0.72	J	5	0.5	PAL
RM-204D	4/23/08	1,1-DICHLOROETHENE	0.95	J	7	0.7	PAL
RM-204D	4/23/08	TRICHLOROETHENE	1	J	5	0.5	PAL
RM-204I	4/23/08	1,1-DICHLOROETHENE	0.82	J	7	0.7	PAL
RM-204I	4/23/08	TRICHLOROETHENE	1	J	5	0.5	PAL
RM-207S	7/17/08	BENZENE	0.94	J	5	0.5	PAL
RM-208D	4/9/08	1,1-DICHLOROETHENE	1.8	J	7	0.7	PAL
RM-208D	7/18/08	1,1-DICHLOROETHENE	2.1		7	0.7	PAL
RM-208D	7/18/08	CIS-1,2-DICHLOROETHENE	7.2		70	7	PAL
RM-208D	4/9/08	TRICHLOROETHENE	2.6		5	0.5	PAL
RM-208D	7/18/08	TRICHLOROETHENE	3.1		5	0.5	PAL
RM-208D DUP	4/9/08	1,1-DICHLOROETHENE	1.9		7	0.7	PAL
RM-208D DUP	7/18/08	1,1-DICHLOROETHENE	2.1		7	0.7	PAL
RM-208D DUP	7/18/08	CIS-1,2-DICHLOROETHENE	7		70	7	PAL
RM-208D DUP	4/9/08	TRICHLOROETHENE	2.6		5	0.5	PAL

Table 6 (continued)
Summary of Volatile Organic Groundwater Standard Exceedences at
Plume Monitoring Wells
Lemberger Landfill Sites
February 2008 - July 2008

WELL ID	DATE	PARAMETER	RESULT (µg/L)	DATA QUALIFIERS	STANDARD[1] (µg/L)		EXCEEDENCE
					ES[2]	PAL[3]	
RM-208D DUP	7/18/08	TRICHLOROETHENE	3.2		5	0.5	PAL
RM-208S	7/18/08	BENZENE	0.85	J	5	0.5	PAL
RM-209D	4/17/08	1,1,1-TRICHLOROETHANE	283		200	40	ES
RM-209D	7/17/08	1,1,1-TRICHLOROETHANE	214		200	40	ES
RM-209D	4/17/08	1,1-DICHLOROETHANE	136		850	85	PAL
RM-209D	7/17/08	1,1-DICHLOROETHANE	85.3		850	85	PAL
RM-209D	4/17/08	1,1-DICHLOROETHENE	11		7	0.7	ES
RM-209D	7/17/08	1,1-DICHLOROETHENE	12.1		7	0.7	ES
RM-209D	4/17/08	CIS-1,2-DICHLOROETHENE	28.3		70	7	PAL
RM-209D	7/17/08	CIS-1,2-DICHLOROETHENE	18.8		70	7	PAL
RM-209D	4/17/08	TETRACHLOROETHENE	1.2	J	5	0.5	PAL
RM-209D	7/17/08	TETRACHLOROETHENE	1.3	J	5	0.5	PAL
RM-209D	4/17/08	TRICHLOROETHENE	13.9		5	0.5	ES
RM-209D	7/17/08	TRICHLOROETHENE	10		5	0.5	ES
RM-210D	3/17/08	1,1-DICHLOROETHENE	2.1		7	0.7	PAL
RM-210D	7/7/08	1,1-DICHLOROETHENE	2.1		7	0.7	PAL
RM-210D	7/7/08	METHYLENE CHLORIDE	0.62	J	5	0.5	PAL
RM-210D	3/17/08	TRICHLOROETHENE	3.8		5	0.5	PAL
RM-210D	7/7/08	TRICHLOROETHENE	3.8		5	0.5	PAL
RM-210D DUP	7/7/08	1,1-DICHLOROETHENE	2.3		7	0.7	PAL
RM-210D DUP	7/7/08	TRICHLOROETHENE	4		5	0.5	PAL
RM-210I	3/17/08	1,1-DICHLOROETHENE	1.2	J	7	0.7	PAL
RM-210I	7/7/08	1,1-DICHLOROETHENE	1.1	J	7	0.7	PAL
RM-210I	3/17/08	TRICHLOROETHENE	2.1		5	0.5	PAL
RM-210I	7/7/08	TRICHLOROETHENE	1.9		5	0.5	PAL
RM-213D	7/15/08	1,1,1-TRICHLOROETHANE	49		200	40	PAL
RM-213D	7/15/08	1,1-DICHLOROETHENE	2.4		7	0.7	PAL

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Table 6 (continued)
Summary of Volatile Organic Groundwater Standard Exceedences at Plume Monitoring Wells
Lemberger Landfill Sites
February 2008 - July 2008

WELL ID	DATE	PARAMETER	RESULT (µg/L)	DATA QUALIFIERS	STANDARD[1] (µg/L)		EXCEEDENCE
					ES[2]	PAL[3]	
RM-213D	7/15/08	CIS-1,2-DICHLOROETHENE	8.8		70	7	PAL
RM-213D	3/16/08	TRICHLOROETHENE	1.3		5	0.5	PAL
RM-213D	7/15/08	TRICHLOROETHENE	3.9		5	0.5	PAL
RM-214D	4/9/08	1,1-DICHLOROETHENE	1.2	J	7	0.7	PAL
RM-214D	7/15/08	1,1-DICHLOROETHENE	1.5	J	7	0.7	PAL
RM-214D	4/9/08	CIS-1,2-DICHLOROETHENE	29.7		70	7	PAL
RM-214D	7/15/08	CIS-1,2-DICHLOROETHENE	38.7		70	7	PAL
RM-214D	4/9/08	TRICHLOROETHENE	4.4		5	0.5	PAL
RM-214D	7/15/08	TRICHLOROETHENE	5.3		5	0.5	ES
RM-214D	4/9/08	VINYL CHLORIDE	1.7		0.2	0.02	ES
RM-214D	7/15/08	VINYL CHLORIDE	1.1		0.2	0.02	ES
RM-303D	4/14/08	1,1,1-TRICHLOROETHANE	984		200	40	ES
RM-303D	7/17/08	1,1,1-TRICHLOROETHANE	379		200	40	ES
RM-303D	4/14/08	1,1-DICHLOROETHANE	654		850	85	PAL
RM-303D	7/17/08	1,1-DICHLOROETHANE	315		850	85	PAL
RM-303D	4/14/08	1,1-DICHLOROETHENE	74.7		7	0.7	ES
RM-303D	7/17/08	1,1-DICHLOROETHENE	15.1		7	0.7	ES
RM-303D	4/14/08	CIS-1,2-DICHLOROETHENE	313		70	7	ES
RM-303D	7/17/08	CIS-1,2-DICHLOROETHENE	116		70	7	ES
RM-303D	4/14/08	TRICHLOROETHENE	93.9		5	0.5	ES
RM-303D	7/17/08	TRICHLOROETHENE	56.8		5	0.5	ES
RM-305D	4/14/08	TRICHLOROETHENE	1	J	5	0.5	PAL
RM-306D	4/14/08	1,1,1-TRICHLOROETHANE	179		200	40	PAL
RM-306D	7/17/08	1,1,1-TRICHLOROETHANE	100		200	40	PAL
RM-306D	4/14/08	1,1-DICHLOROETHENE	7.5		7	0.7	ES
RM-306D	7/17/08	1,1-DICHLOROETHENE	3.3		7	0.7	PAL
RM-306D	4/14/08	TETRACHLOROETHENE	0.88	J	5	0.5	PAL

Table 6 (continued)
Summary of Volatile Organic Groundwater Standard Exceedences at Plume Monitoring Wells
Lemberger Landfill Sites
February 2008 - July 2008

WELL ID	DATE	PARAMETER	RESULT (µg/L)	DATA QUALIFIERS	STANDARD[1] (µg/L)		EXCEEDENCE
					ES[2]	PAL[3]	
RM-306D	7/17/08	TETRACHLOROETHENE	0.54	J	5	0.5	PAL
RM-306D	4/14/08	TRICHLOROETHENE	4.5		5	0.5	PAL
RM-306D	7/17/08	TRICHLOROETHENE	4.3		5	0.5	PAL
RM-307D	4/17/08	1,1,1-TRICHLOROETHANE	57.3		200	40	PAL
RM-307D	7/17/08	1,1,1-TRICHLOROETHANE	107		200	40	PAL
RM-307D	4/17/08	1,1-DICHLOROETHENE	1.5	J	7	0.7	PAL
RM-307D	7/17/08	1,1-DICHLOROETHENE	3.7		7	0.7	PAL
RM-307D	4/17/08	TRICHLOROETHENE	2.5		5	0.5	PAL
RM-307D	7/17/08	TRICHLOROETHENE	5.6		5	0.5	ES

Notes:
(1) Table includes exceedences where the reported concentration is between the Limit of Detection and the Limit of Quantitation (J data qualifier).
(2) ES = Wisconsin Administrative Code NR140 Enforcement Standard.
(3) PAL = Wisconsin Administrative Code NR140 Preventive Action Limit.
J = reported concentration is estimated between the Limit of Detection (LOD) and the Limit of Quantitation (LOQ).

Table 7
Summary of Private Well Construction Information
Lemberger Landfill and Lemberger Transport and Recycling Site
Town of Franklin, Manitowoc County, Wisconsin

WELL DESIGNATION	WISCONSIN UNIQUE WELL NUMBER(S)	CASING DEPTH (ft)	TOTAL DEPTH (ft)	CONSTRUCTION MO-YR	STREET ADDRESS OF WELL LOCATION	OWNER	RESIDENT	NAME ON WELL CONSTRUCTOR'S REPORT	NOTES
GR-8	BK413	250	262	Apr-1986	7504 Taus Road	Richard Eiles	Same	Tom Hanly	BK349 also assigned
GR-9	BK415	250	342	Nov-1985	7435 Taus Road	Harlan Saur	None	Edwin Saur	
	BK350	*Not known*	*40*	*Not known*	*Rt 1, Box 302 (Whitelaw)*	*Edwin Saur*		*no log*	*Assumed to be abandoned*
GR-10	EZ331	250	480	Not known	7321 Taus Road	Jeff Wilker	Same	no log	
GR-11	BK416	253	362	Apr-1986	7208 Taus Road	Jane Kalies	Same	Jane Kalies	
	BK364	*59*	*87*	*Jan-1967*	*Rt 1, Box 302A (Whitelaw)*	*Jane Kalies*		*Douglas Kalies*	*Assumed to be abandoned*
GR-12	CW004	252	318	Sep-1985	13116 Reifs Mills Road	John Dugan	Same	John Dugan	
	BK355	*Not known*	*86*	*Not known*	*Rt 1 (Whitelaw)*	*John Dugan*		*no log*	*Assumed to be abandoned*
GR-13	BK381	Not known	Not known	Not known	13207 Reifs Mills Road	Emily Kubicka	Same	no log	
GR-14	BK363	43	45	Jul-1981	13416 Reifs Mills Road	Rosemary Schneider	Same	Donald Schneider	
GR-15	BK409	Not known	Not known	Not known	13323 Reifs Mills Road	Chad Olm	Same	no log	
GR-16	BK371	Not known	Not known	Not known	6512 River Bend Road	Karl Schultz	Same	no log	BK371 assigned to GR-16, although the address and owner (13535 River Bend Road, Dale Novak) do not match, 13535 not a valid address
GR-17	BK410	250	318	Nov-1985	12933 Reifs Mills Road	Wayne Menza	Same	Wayne Menza	
	BK354	*Not known*	*50*	*Not known*	*Rt 1 (Whitelaw)*	*Wayne Menza*		*no log*	*Assumed to be abandoned*
GR-24	BK366	42	182	Aug-1982	12330 Sunny Slope Road	Waste Management, Inc.	N/A	Norbert Braun	
GR-25	BK365	Not known	Not known	Not known	5925 Hempton Lake Road	Edward Baroun	Same	no log	
GR-26	AO649	210	256	Mar-1982	13116 Sunny Slope Road	Kenney Lemberger	None	Ken Lemberger	BK377 and AP022 also assigned
GR-27	BK353	Not known	Not known	Not known	6203 Ledvina Road	Rose Mary Ledvina	Same	no log	
GR-30	BK414	252	342	Mar-1986	5330 Hempton Lake Road	Terry Lemberger	Casey Lemberger	Alice Lemberger	
	BK383	*Not known*	*120*	*Not known*	*Rt 1 Hempton Lake Rd (Whitelaw)*	*Alice Lemberger*		*no log*	*Assumed to be abandoned*
GR-31	BK376	40	163	May-1970	12504 Palm Grove Road	Ervin Polifka	Same	Ervin Polifka	
GR-33	BK375	Not known	Not known	Not known	4833 Mayerl Road	Richard Lodel	Same	no log	
GR-41	BK391	Not known	Not known	Not known	12435 Palm Grove Road	Tom Ebert	Same	no log	
GR-60R	IG758	252	361	Jun-1994	13418 Sunny Slope Road	Michael Golen	None	Leo Denor	AP022 also assigned
GR-62	HL794	250	322	Oct-1993	7325 Taus Road	Carl Franz	Same	Tony Franz	
GR-63	DS921	252	320	Mar-1992	12820 Reifs Mills Road	James Einburger	Same	Jim Einberger	
GR-64	IE118	250	380	Apr-1995	12815 Reifs Mills Road	Per Engstrom	Same	Floyd Lonzo	
GR-65	LK291	253	360	Dec-1996	6726 River Bend Road	Corliss & Diana Prindle	Same	Corliss Prindle	Log lists address of 13535C Riefs Mills Road, 13535 not a valid address

Table 8
Long-Term MNA Sampling Program

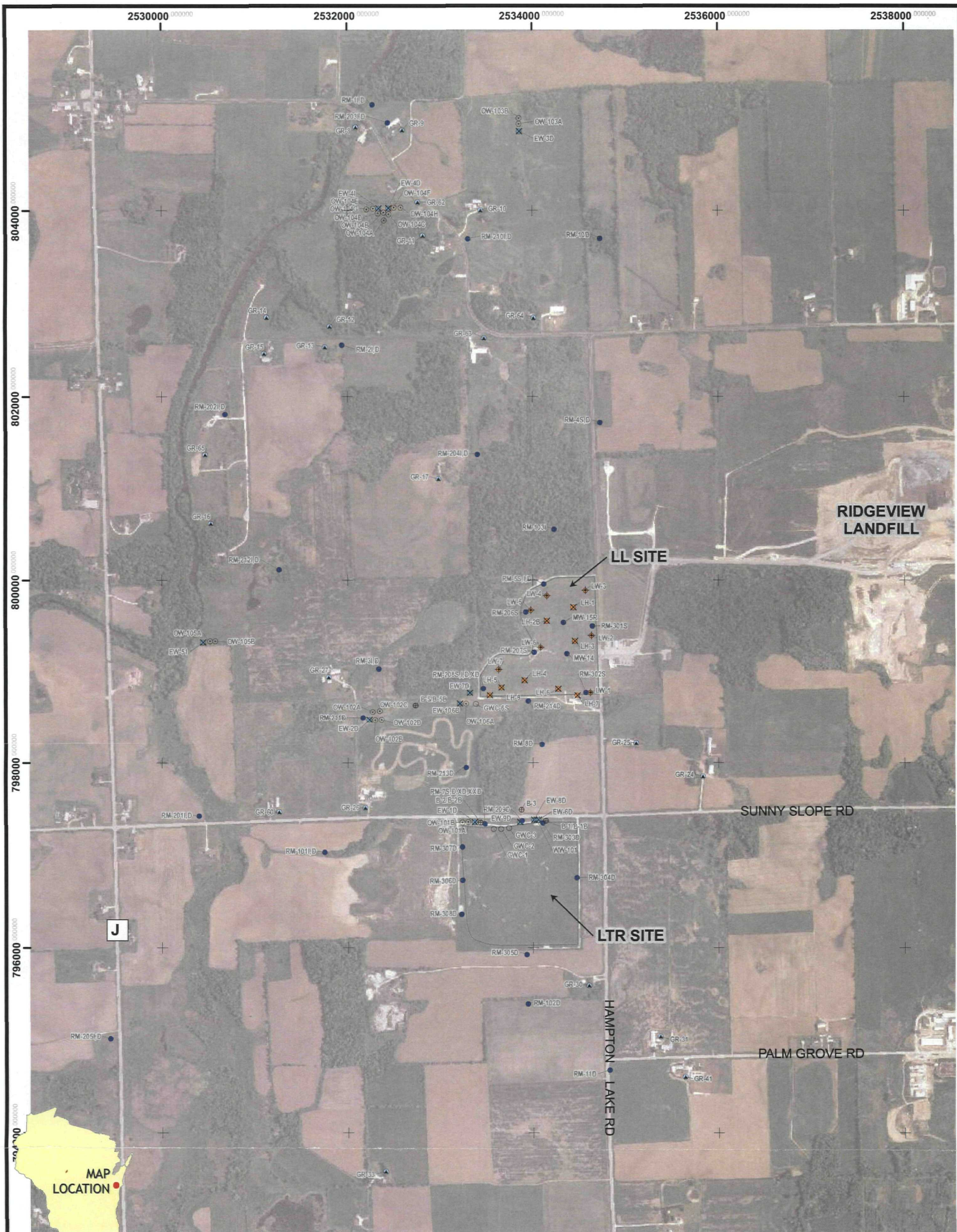
WELL GROUPING/ DESIGNATIONS	SAMPLING FREQUENCY	LABORATORY ANALYTICAL PARAMETERS[1]	FIELD ANALYTICAL PARAMETERS[1]
53 Existing Monitoring Wells	Quarterly (March, June, September and December)	None	Depth to Water
LTR Sentinel Wells: RM-3D[2], RM-211D, RM-212I, RM-212D, RM-2D, RM-210I, RM-210D, RM-203I, RM-203D	Quarterly (March, June, September and December)	VOCs Alkalinity, chloride, Manganese, Nitrate, Nitrite, Sulfate, and TIC	CO_2, ORP, pH, Temperature, Specific conductivity, Turbidity, DO
LTR Near-Field Wells: RM-303D, RM-209D, RM-7S, RM-7D, RM-7XD, RM-7XXD, RM-8D, RM-214D, RM-208D, RM-208XD, RM-5D	Quarterly (March, June, September and December)	VOCs Alkalinity, chloride, Manganese, Nitrate, Nitrite, Sulfate, and TIC	CO_2, ORP, pH, Temperature, Specific conductivity, Turbidity, DO
LTR Plume Wells[3]: RM-305D, RM-306D, RM-304D, RM-307D, RM-101D, RM-213D, RM-103D, RM-204I, RM-204D	Semiannually (March, September)	VOCs Alkalinity, chloride, Manganese, Nitrate, Nitrite, Sulfate, and TIC	CO_2, ORP, pH, Temperature, Specific conductivity, Turbidity, DO
LTR Plume Wells: RM-11D, RM-102D, RM-308D, RM-101I, RM-3I, RM-208S, RM-208I, RM-5I, RM-103S, RM-4S, RM-4D, RM-2I, RM-10D	Annually (September)	VOCs Alkalinity, chloride, Manganese, Nitrate, Nitrite, Sulfate, and TIC	CO_2, ORP, pH, Temperature, Specific conductivity, Turbidity, DO
LL Wells[4]: RM-301S, RM-302S, RM-207S, RM-206S, RM-5S	Annually (September)	VOCs Alkalinity, chloride, Manganese, Nitrate, Nitrite, Sulfate, and TIC	CO_2, ORP, pH, Temperature, Specific conductivity, Turbidity, DO

Table 8 (continued)
Long-Term MNA Sampling Program

WELL GROUPING/ DESIGNATIONS	SAMPLING FREQUENCY	LABORATORY ANALYTICAL PARAMETERS[1]	FIELD ANALYTICAL PARAMETERS[1]
Residential Wells: GR-13, GR-14, GR-15, GR-25, GR-26, GR-27, GR-60R,	Semiannually (March, September)	VOCs	ORP, pH, Temperature, Specific conductivity, Turbidity
GR-8, GR-9, GR-10, GR-11, GR-12, GR-16, GR-17, GR-24, GR-30, GR-31, GR-33, GR-41, GR-62, GR-63, GR-64, GR-65	Annually (September)	VOCs	ORP, pH, Temperature, Specific conductivity, Turbidity

Notes:
[1] = MNA laboratory and field-analytical methods and reporting limits are listed in Table 4 of the MNA Summary Report.
[2] = RM-3D moved from annual to quarterly sampling, per USEPA request.
[3] = This list of LTR plume wells moved from annual to semi-annual, per WDNR request.
[4] = RM-301S, RM-302S and RM-5S are located inside of the LL slurry wall.

VOCs = Volatile organic compounds, laboratory analyzed via EPA Method 8260B.
TIC = Total Inorganic Carbon.
CO_2 = Carbon dioxide.
ORP = Oxidation-reduction potential.
DO = Dissolved oxygen.



LEGEND

SAMPLE AND MONITORING LOCATIONS

- ⊕ BEDROCK BORING
- ○ GW COLLECTION SUMP (GWC)
- ✖ GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- ✖ LEACHATE HEAD WELL (LH)
- ✦ LEACHATE WITHDRAWL WELL (LW)
- ● MONITORING WELL (RM)
- ▲ RESIDENTIAL WELL (GW)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.

0 1,000 FEET
1" = 1,000'
1:12,000
N

PROJECT:	LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN		
SHEET TITLE:	MNA DEMONSTRATION PROJECT SITE PLAN SHOWING ALL MONITORING POINTS		
DRAWN BY: HANKLEY C	SCALE:	PROJ. NO. 00-03457.46	
CHECKED BY: THC	AS NOTED	FILE NO. 34574601.mxd	
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	FIGURE 1	
DATE: DECEMBER 2008			

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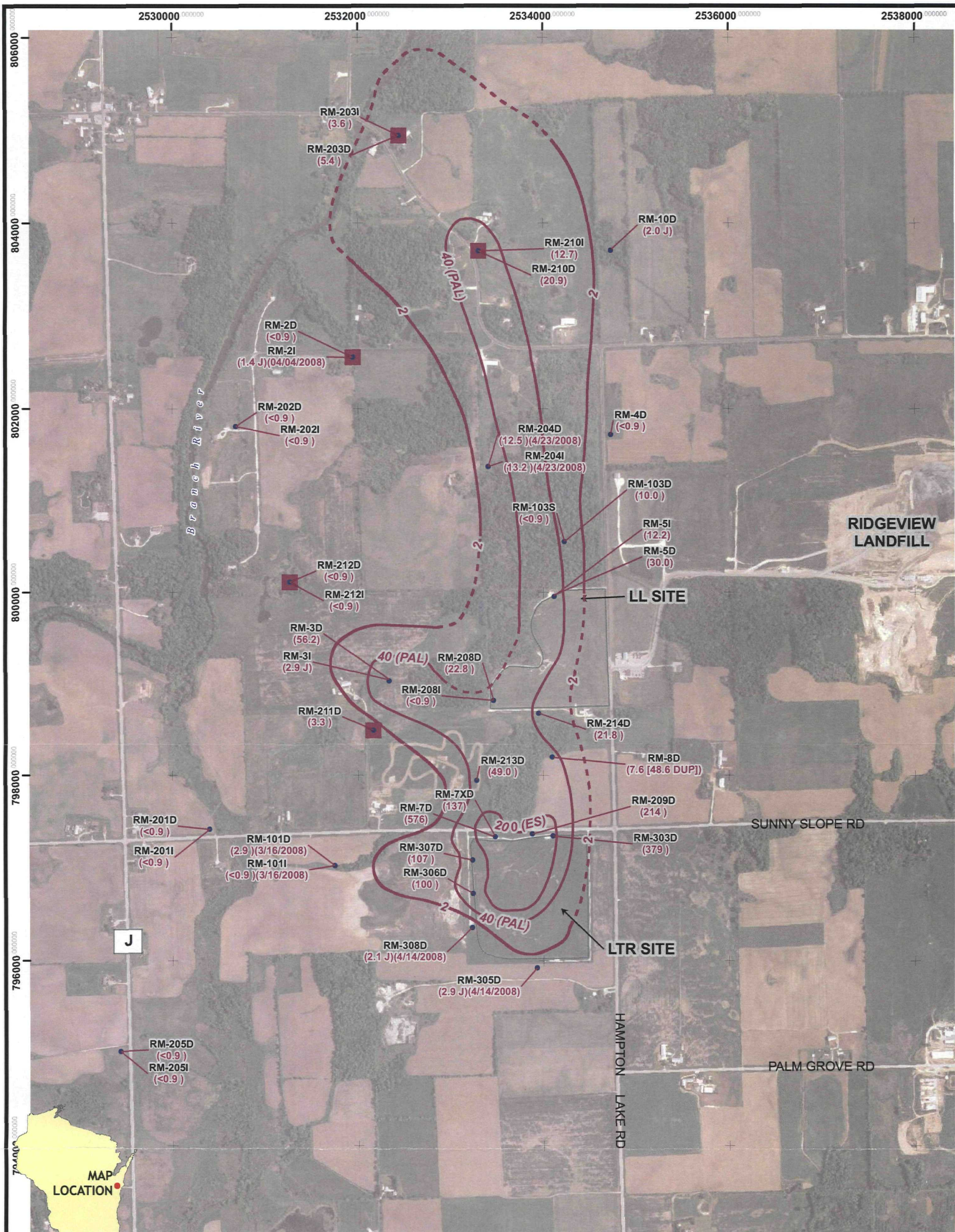

LEGEND

- MONITORING WELL
- SENTINEL WELLS
- 20 — 1,1,1-TCA ISO-CONCENTRATION (DASHED WHERE INFERRED)

1,1,1-TCA SAMPLES USED FOR ISO-LINES
LABELS SHOW CONCENTRATION (UG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008

RM-208
(825.53)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. 1,1,1-TCA WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

0 1,000 FEET
N
1" = 1,000'
1:12,000

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE: 1,1,1-TCA CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008

DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO. 00-03457.46	
CHECKED BY: THC	AS NOTED	FILE NO. 34574606.mxd	
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	FIGURE 2	
DATE: DECEMBER 2008			

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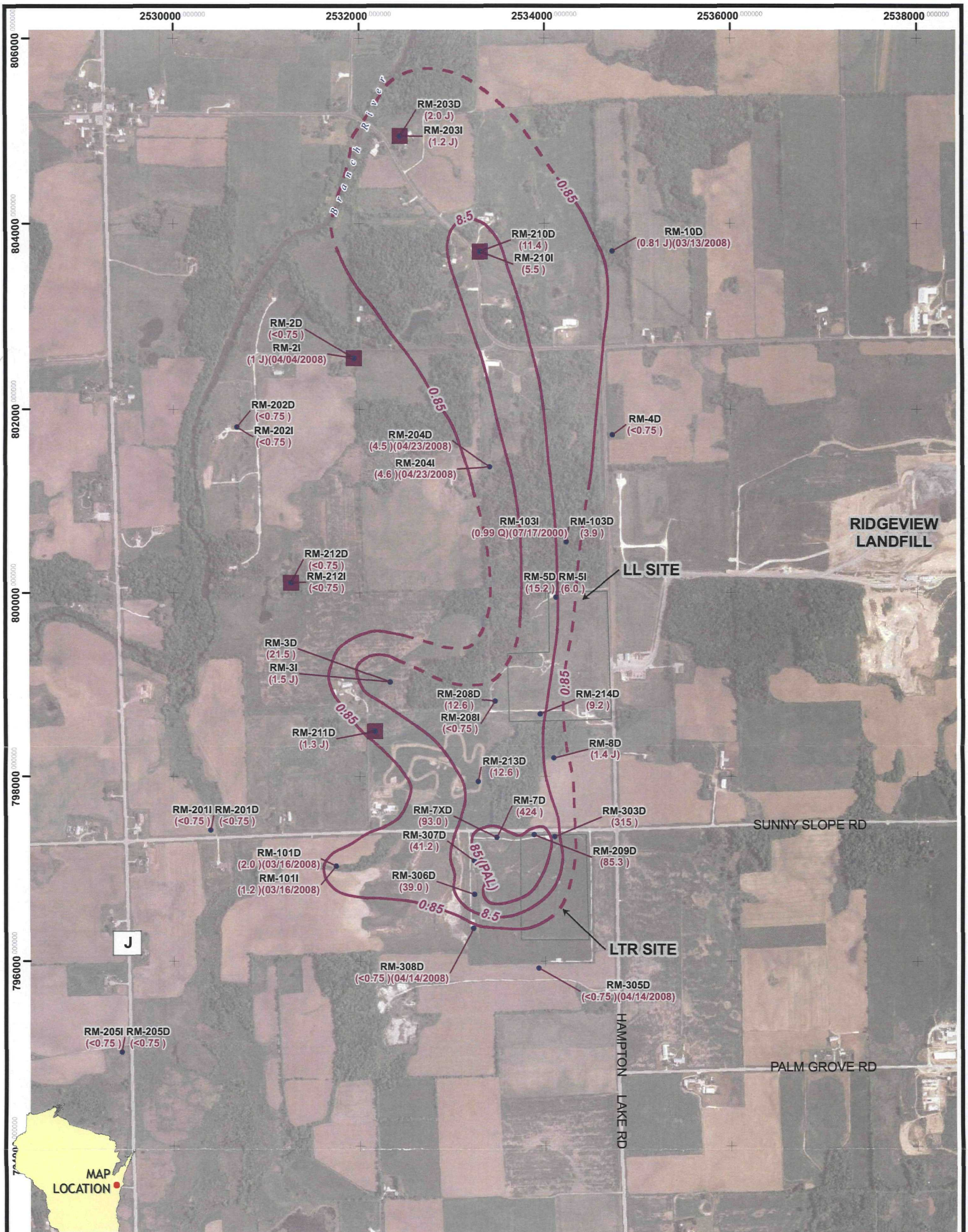

LEGEND

- MONITORING WELL
- SENTINEL WELLS
- 8.5 — 1,1-DCA ISO-CONCENTRATION (*DASHED WHERE INFERRED*)

1,1-DCA SAMPLES USED FOR ISO-LINES
LABELS SHOW CONCENTRATION (UG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008

RM-212D
(<0.48)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. 1,1-DCA WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

0 — 1,000 FEET
1" = 1,000'
1:12,000

N

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **1,1-DCA CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008**

DRAWN BY:	MCKEEFRY J	SCALE:		PROJ. NO.	00-03456.44
CHECKED BY:	THC	AS NOTED		FILE NO.	34574607.mxd
APPROVED BY:	JDW	DATE PRINTED:	12/22/2008	**FIGURE 3**	
DATE:	DECEMBER 2008				

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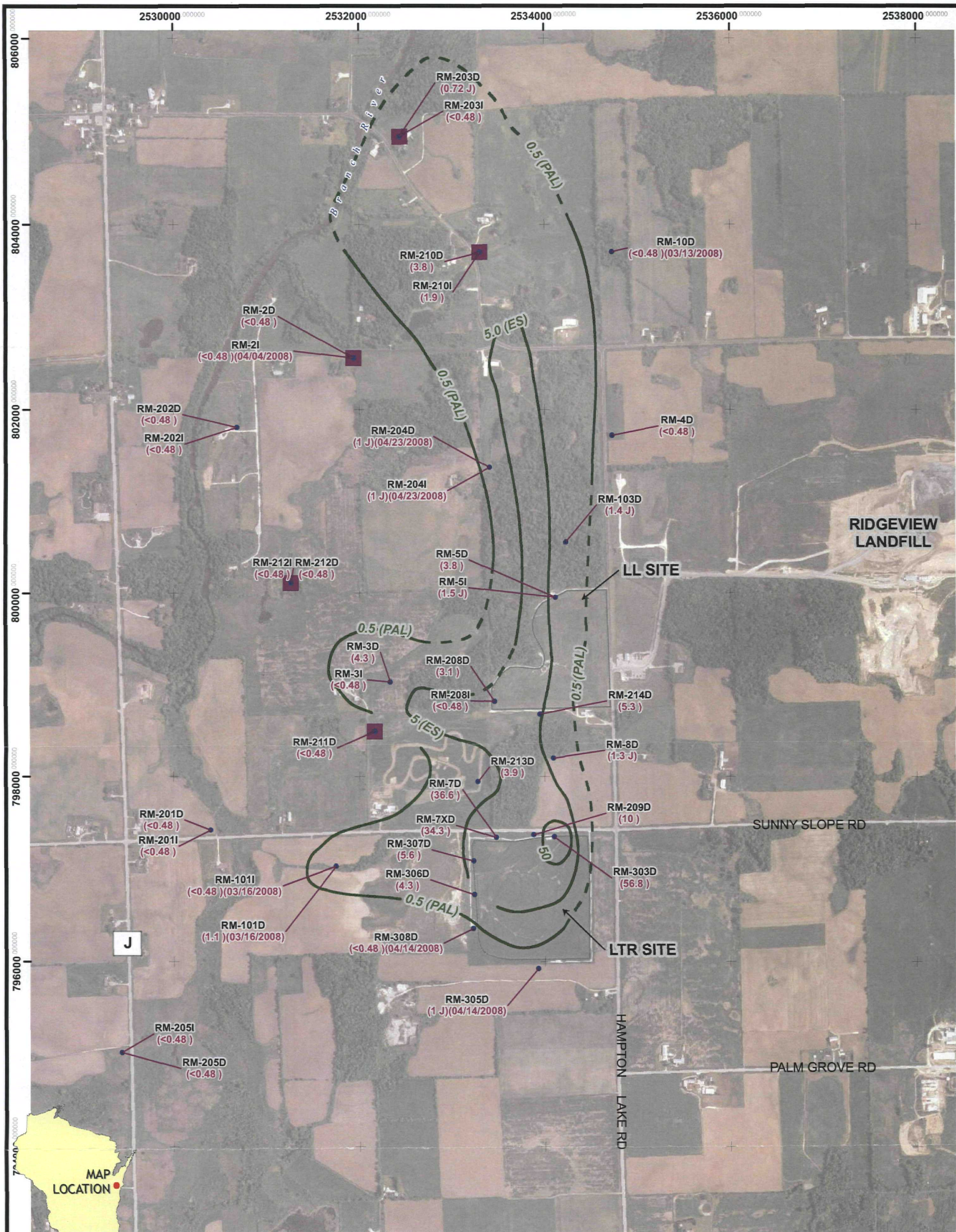

LEGEND

- MONITORING WELL
- SENTINEL WELLS
- 5 TCE ISO-CONCENTRATION (DASHED WHERE INFERRED)

TCE SAMPLES USED FOR ISO-LINES
LABELS SHOW CONCENTRATION (UG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008

RM-212D
(<0.48)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. TCE WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

N

0 1,000 FEET

1 " = 1,000 '
1:12,000

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **TCE CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008**

DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574608.mxd
APPROVED BY: JDW	DATE PRINTED:		
DATE: DECEMBER 2008	12/22/2008	**FIGURE 4**	

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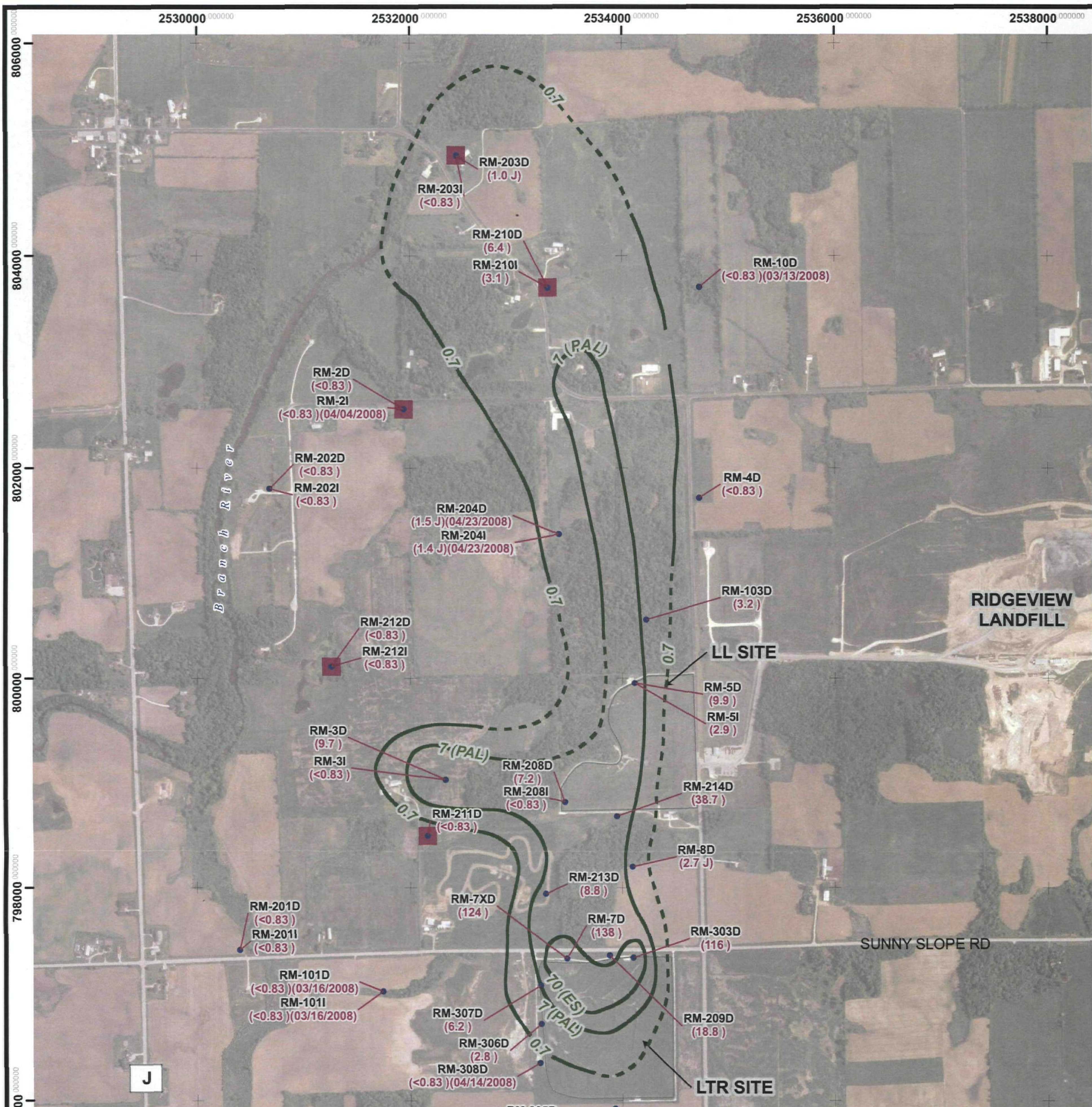

LEGEND

- MONITORING WELL (RM)
- SENTINEL WELLS
- 20 CIS-1,2-DCE ISO-CONCENTRATION (DASHED WHERE INFERRED)

CIS-1,2-DCE SAMPLES USED FOR ISO-LINES
LABELS SHOW CONCENTRATION (UG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008

RM-208
(825.53)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. CIS-1,2-DCE WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

N

0 1,000 FEET
1 " = 1,000 '
1:12,000

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **CIS-1,2-DCE CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008**

DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574609.mxd
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	**FIGURE 5**	
DATE: DECEMBER 2008			

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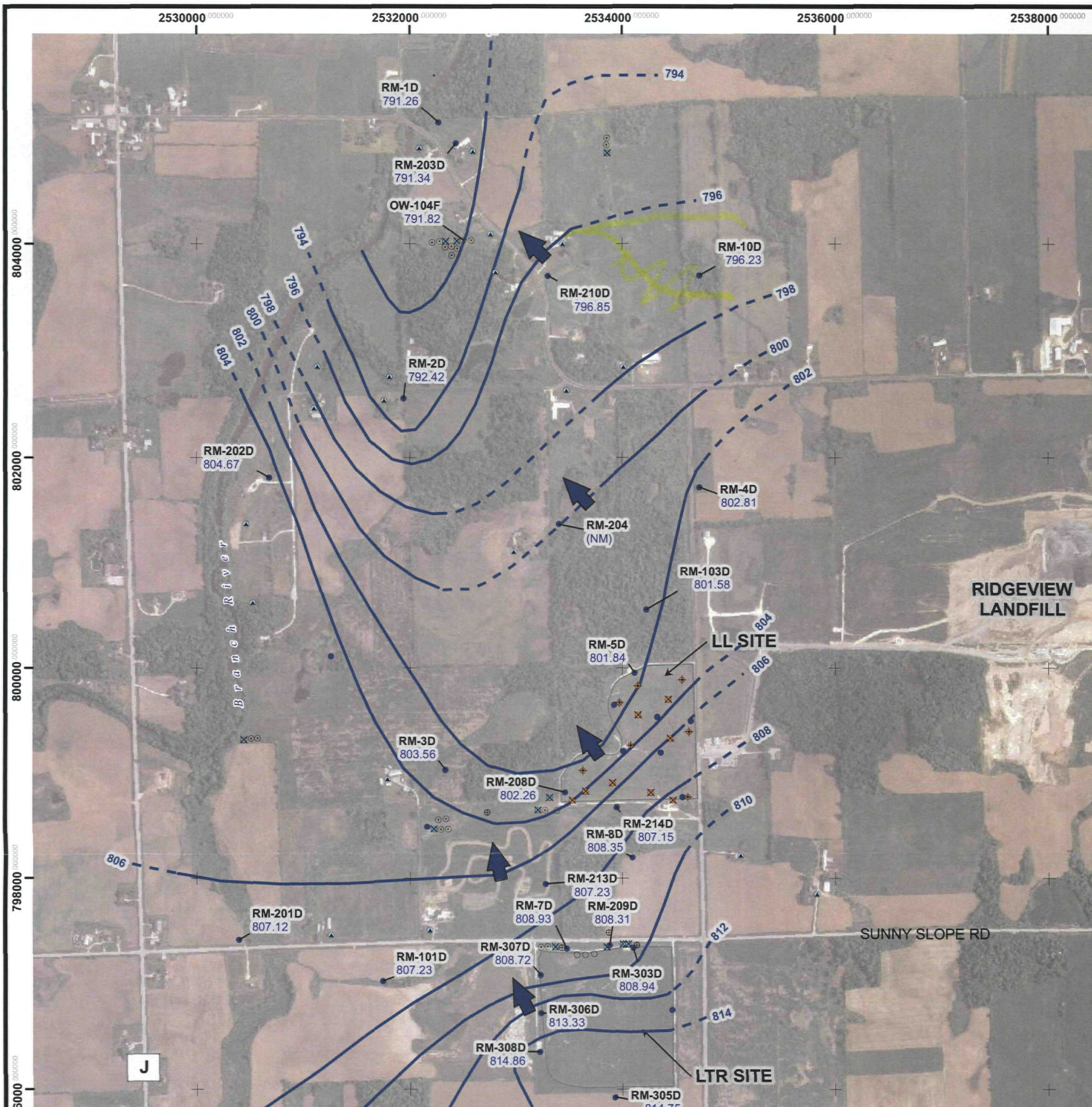

LEGEND

SAMPLE AND MONITORING LOCATIONS

- ⊕ BEDROCK BORING
- ○ GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- ● MONITORING WELL (RM)
- RESIDENTIAL WELL (GW)
- LANDFILL AREA

INFERRED GROUNDWATER FLOW DIRECTION

BEDROCK WELL LOCATION AND GROUNDWATER ELEVATIONS (FT MSL)

RM-205D
(804.83)

Elevation Contour FT MSL.
2 FT Contour Interval
(Dashed Where Inferred)

808

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. WATER ELEVATIONS MEASURED JULY 3, 2008.
4. THE MAPPED POTENTIOMETRIC SURFACE INCLUDES BEDROCK WATER TABLE OBSERVATION WELLS (SOUTH AND EAST) AND BEDROCK PIEZOMETERS (NORTH AND WEST).

N

0 1,000 FEET 1:12,000
1" = 1,000'

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **BEDROCK POTENTIOMETRIC SURFACE JULY 2008**

DRAWN BY:	BENTON K	SCALE:		PROJ. NO.	00-03457.46
CHECKED BY:	THC	AS NOTED		FILE NO.	34574604.mxd
APPROVED BY:	JDW	DATE PRINTED:			
DATE:	DECEMBER 2008	12/22/2008		**FIGURE 6**	

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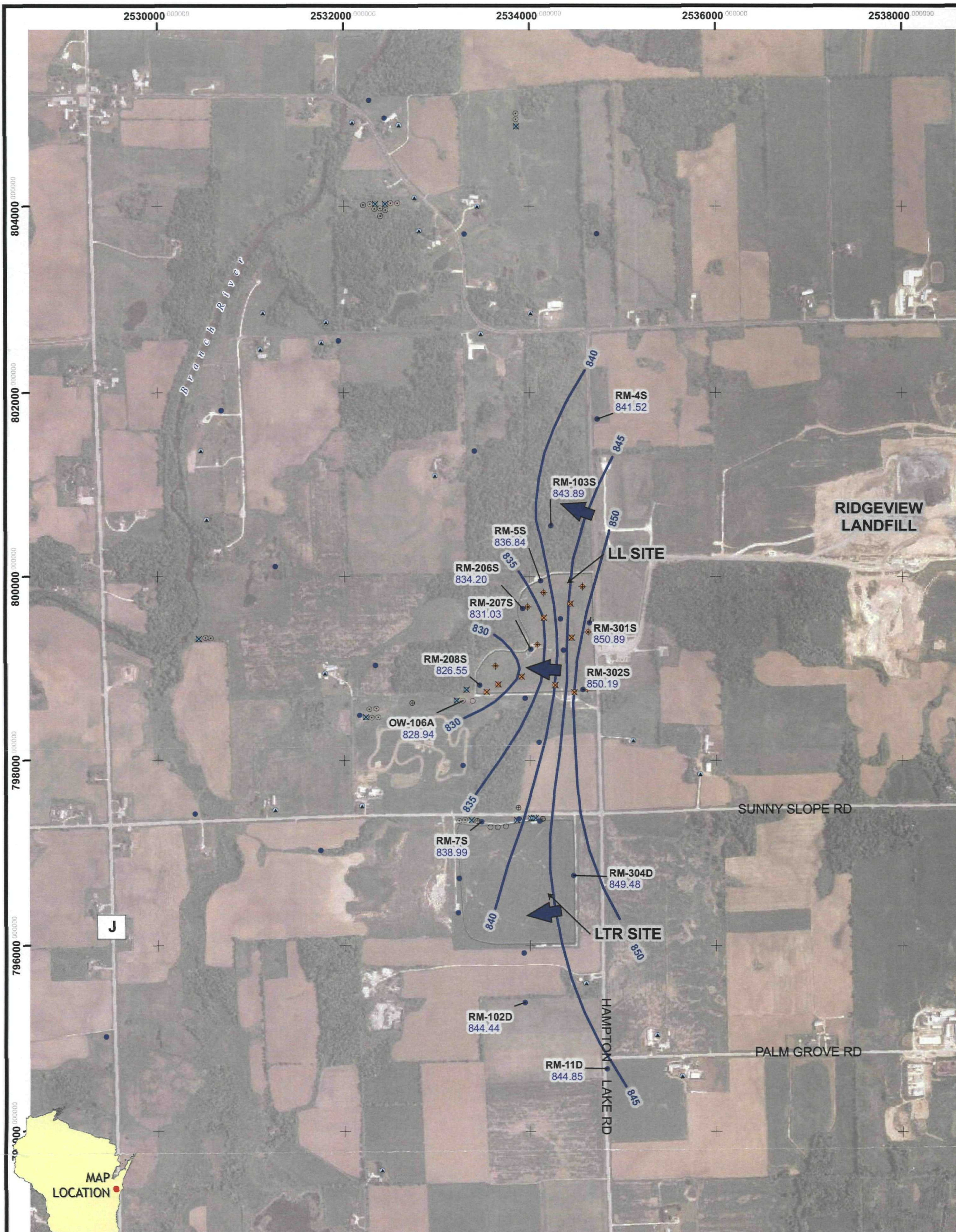

LEGEND

SAMPLE AND MONITORING LOCATIONS

- ⊕ BEDROCK BORING
- ○ GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- ● MONITORING WELL (RM)
- RESIDENTIAL WELL (GW)
- LANDFILL AREA

INFERRED GROUNDWATER FLOW DIRECTION

PERCHED WATER TABLE WELL LOCATION AND WATER TABLE ELEVATIONS (FT MSL)

RM-11D
(842.33)

Elevation Contour FT MSL.
5 FT Contour Interval
(Dashed Where Inferred)

840

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. WATER ELEVATIONS MEASURED JULY 3, 2008.

0 1,000 FEET

1" = 1,000'
1:12,000

N

PROJECT:	LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN		
SHEET TITLE:	PERCHED WATER TABLE JULY 2008		
DRAWN BY: BENTON K	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574603.mxd
APPROVED BY: JDW	DATE PRINTED:	FIGURE 7	
DATE: DECEMBER 2008	12/22/2008		

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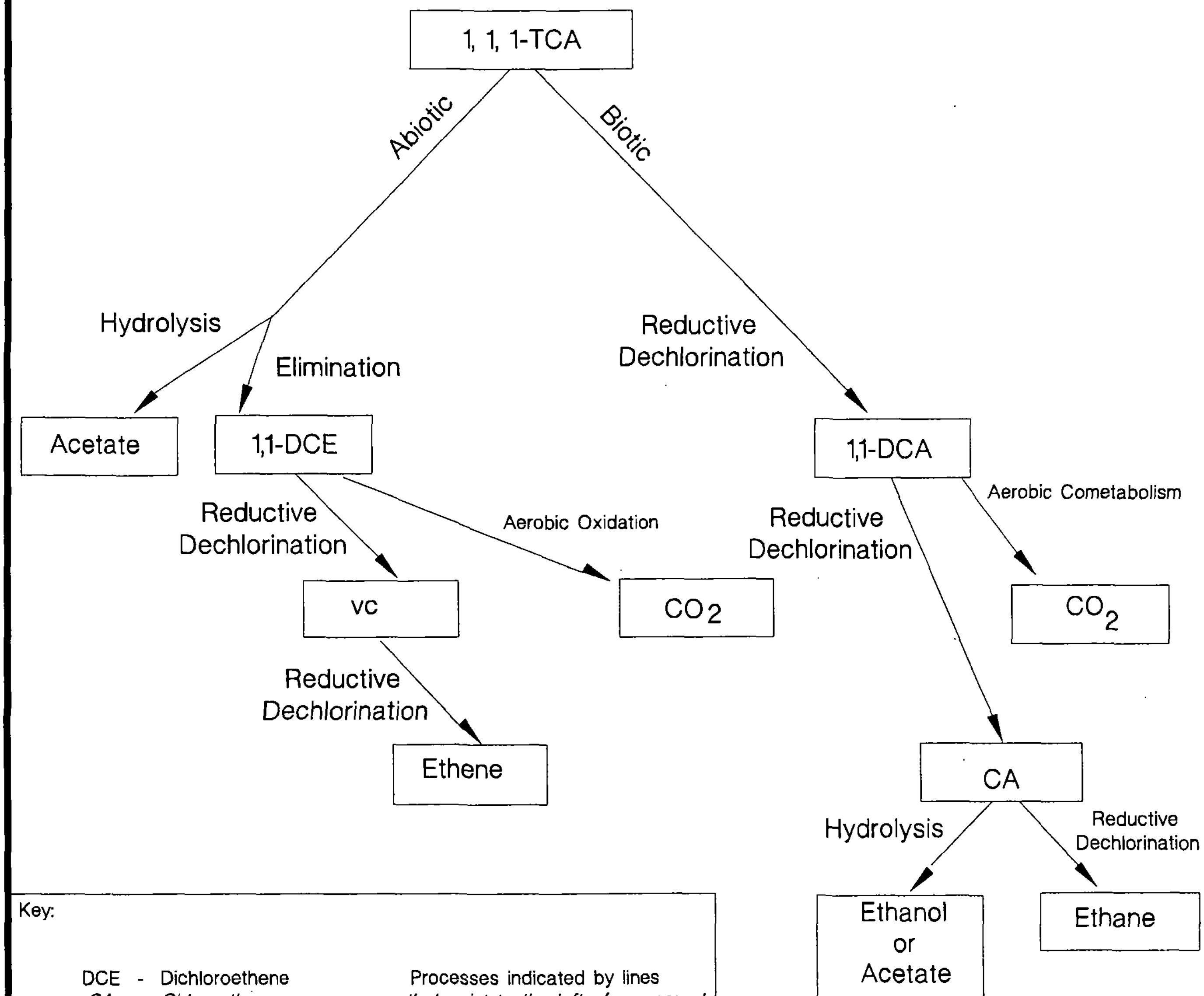
Operator Name: noldenr Scale: 1"=1'



Key:

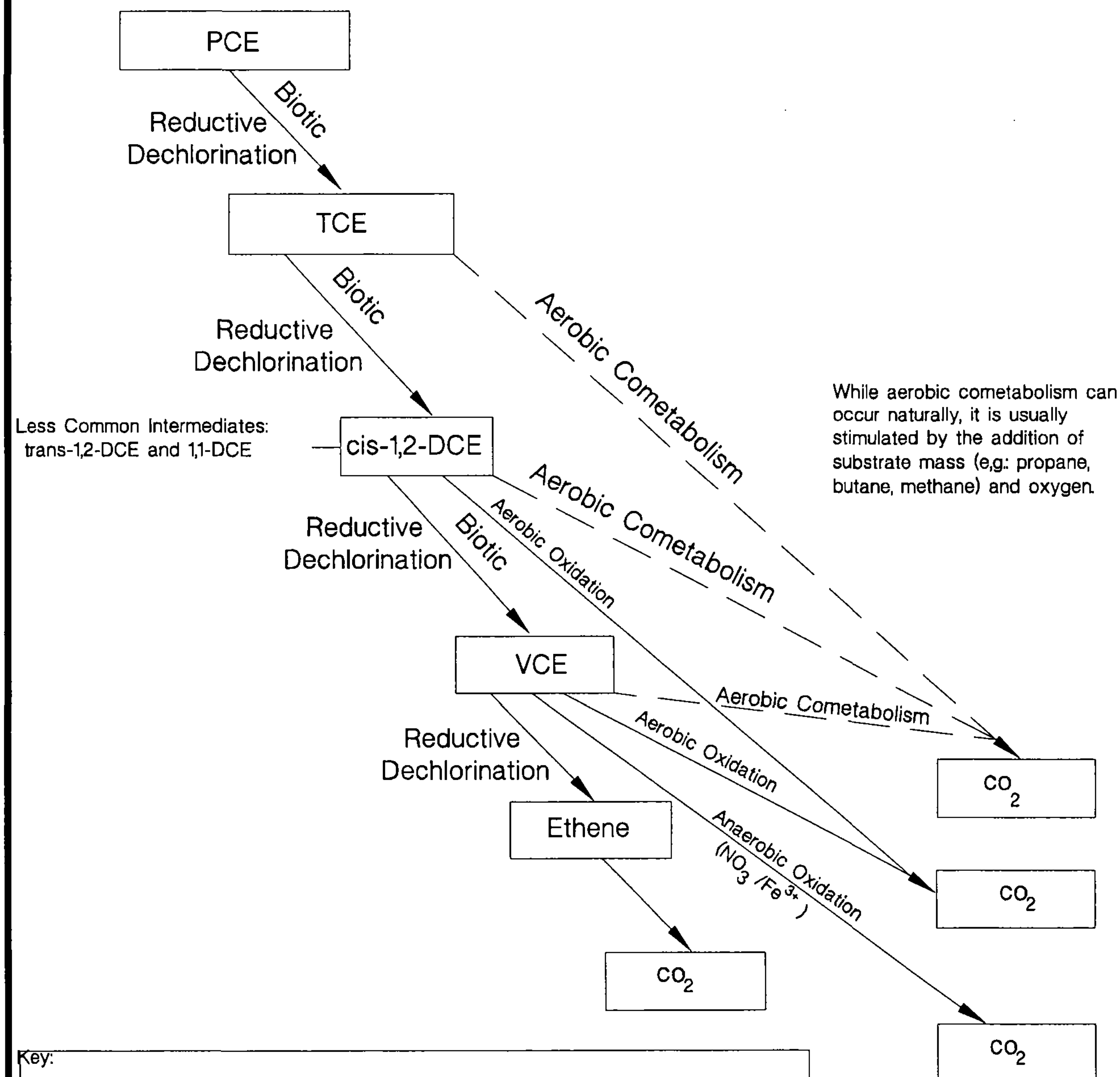
DCE - Dichloroethene
CA - Chloroethane
TCE - Trichloroehtene
VC - Vinyl Chloride

Processes indicated by lines that point to the left of compound are abiotic chemical reactions, while those that point to the right nvolve biotic degradation.

Reference: US EPA [1998]

RMT	LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITE TOWN OF FRANKLIN, WISCONSIN	DRAWN BY: NOLDENR
		APPROVED BY: JW
		PROJECT NO. 3457.46
	COMMON DEGRADATION PATHWAYS FOR CHLORINATED ETHANES FIGURE 10	FILE NO. 34574602.DWG
		DATE: DECEMBER 2008

PLOT DATA
Drawing Name: J:\03457\46\34574601.DWG
Operator Name: noldenr Scale: 1"=1'



Key:

DCE - Dichloroethene
PCE - Tetrachloroethene
TCE - Trichloroehtene
VC - Vinyl Chloride

Processes indicated by lines that point to the left of compound are abiotic chemical reactions, while those that point to the right involve biotic degradation.

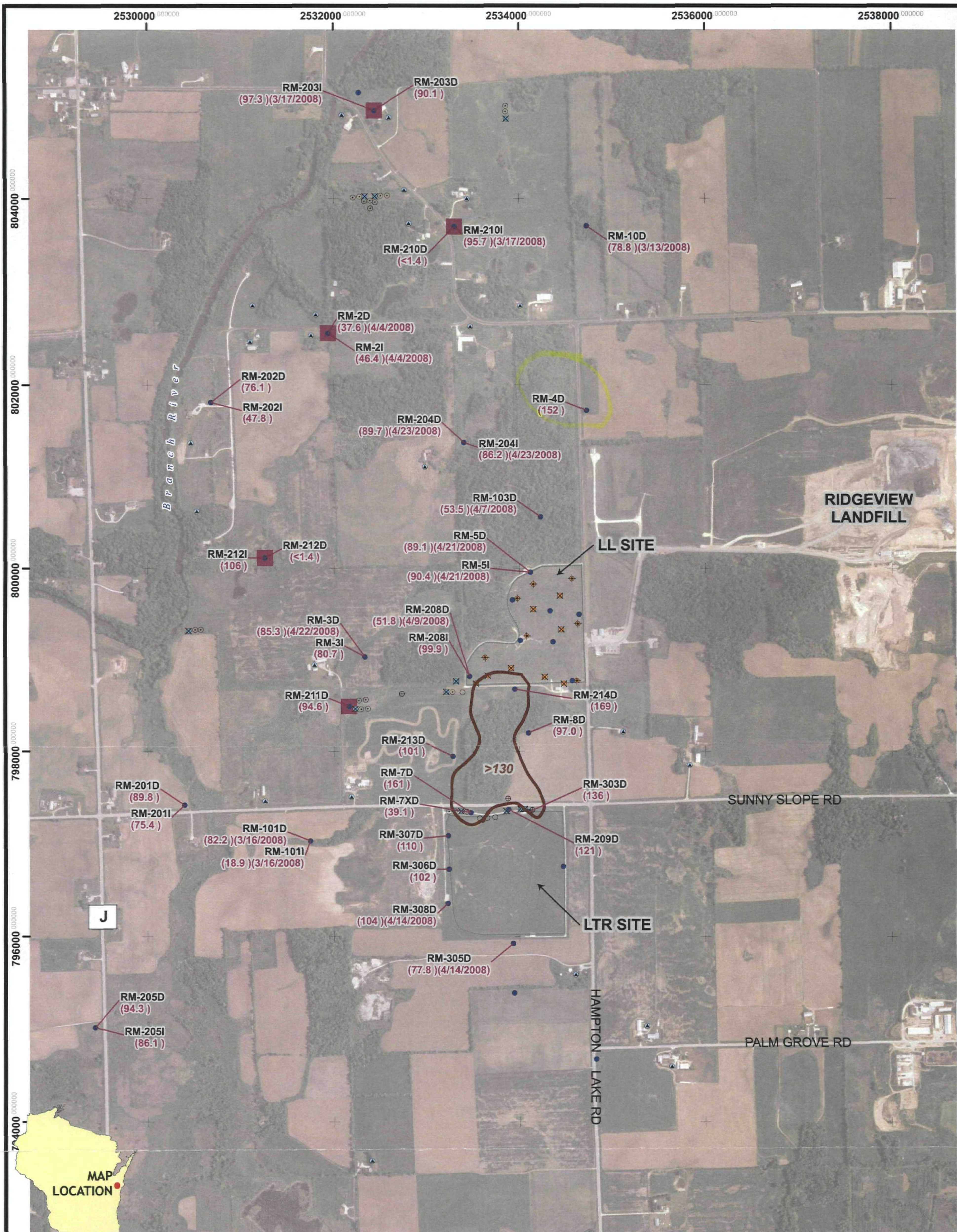
Reference: US EPA [1998]

RMT

LEMBERGER LANDFILL AND
LEMBERGER TRANSPORT AND RECYCLING SITES
TOWN OF FRANKLIN, WISCONSIN

COMMON DEGRADATION PATHWAYS
FOR CHLORINATED ETHENES
FIGURE 11

DRAWN BY:	NOLDENR
APPROVED BY:	JW
PROJECT NO.	3457.46
FILE NO.	34574601.DWG
DATE:	DECEMBER 2008



LEGEND

- MONITORING WELL (RM)
- SENTINEL WELLS
- >130 TIC ISO-CONCENTRATION

TIC SAMPLES USED FOR ISO-LINES
LABELS SHOW CONCENTRATION (MG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008

RM-3D
(85.3)(4/22/2008)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. RM-7XD WAS NOT USED FOR CONTOURING.

N

0 1,000 FEET
1" = 1,000'
1:12,000

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN			
SHEET TITLE: TOTAL INORGANIC CARBON CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008			
DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574612.mxd
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	FIGURE 12	
DATE: DECEMBER 2008			

RMT
744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

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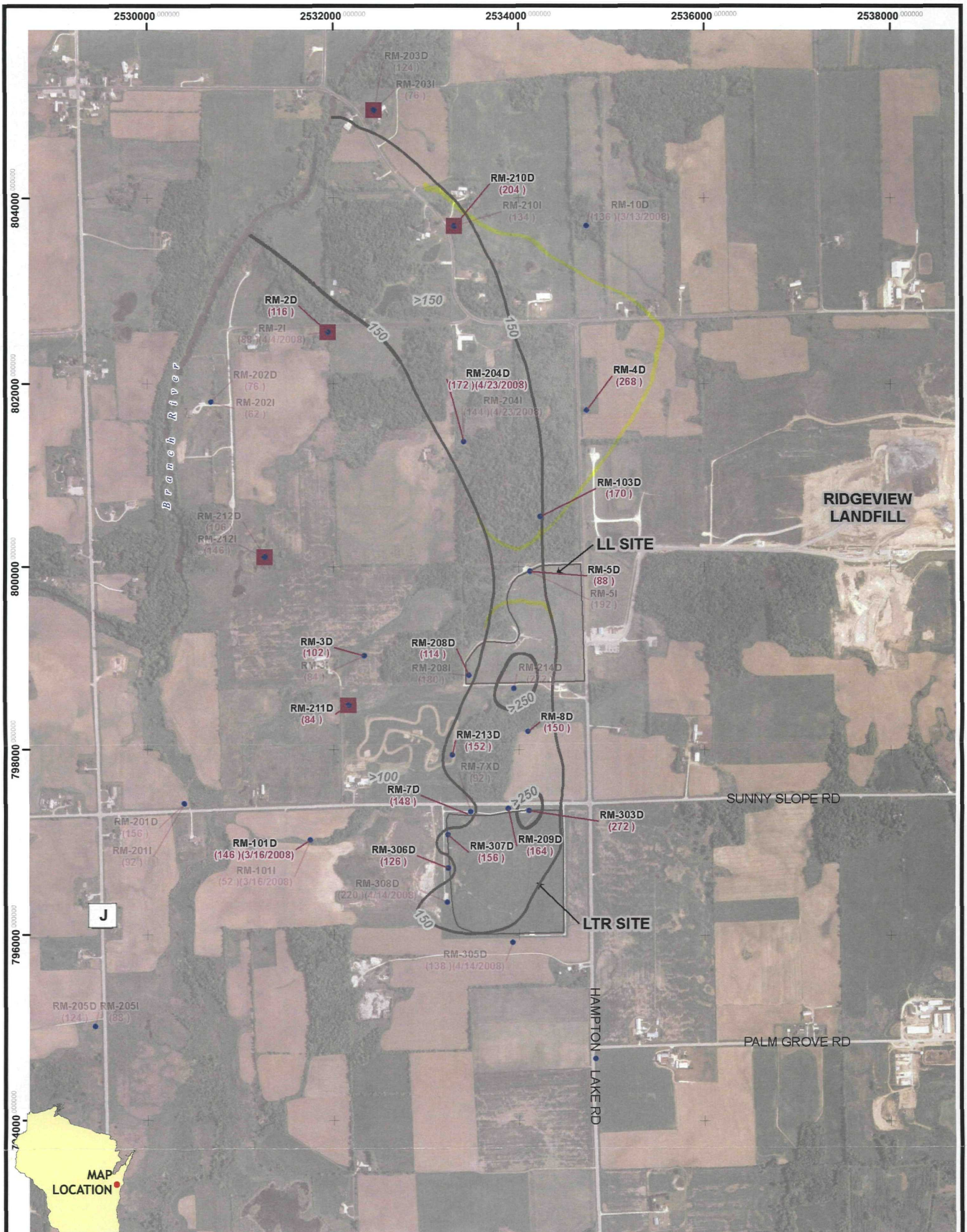

LEGEND

- MONITORING WELL (RM)
- SENTINEL WELLS
- 20 ——— CO_2 ISO-CONCENTRATION **FOR BEDROCK ONLY** *(DASHED WHERE INFERRED)*

CO_2 SAMPLES USED FOR ISO-LINES
LABELS SHOW CONCENTRATION (MG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008

RM-208
(825.53)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. WELLS/RESULTS SHOWN IN BOLD FONT WERE USED FOR CONTOURING.
4. BEDROCK WELLS RM-205D, RM-201D AND RM-202D WERE NOT USED FOR CONTOURING.

N

0 1,000 FEET
1" = 1,000'
1:12,000

PROJECT:	**LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**		
SHEET TITLE:	**CARBON DIOXIDE CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008 (ISO-CONCENTRATIONS FOR BEDROCK WELLS ONLY)**		
DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574610.mxd
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	**FIGURE 13**	
DATE: DECEMBER 2008			

RMT
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Phone: 608-831-4444
Fax: 608-831-3334

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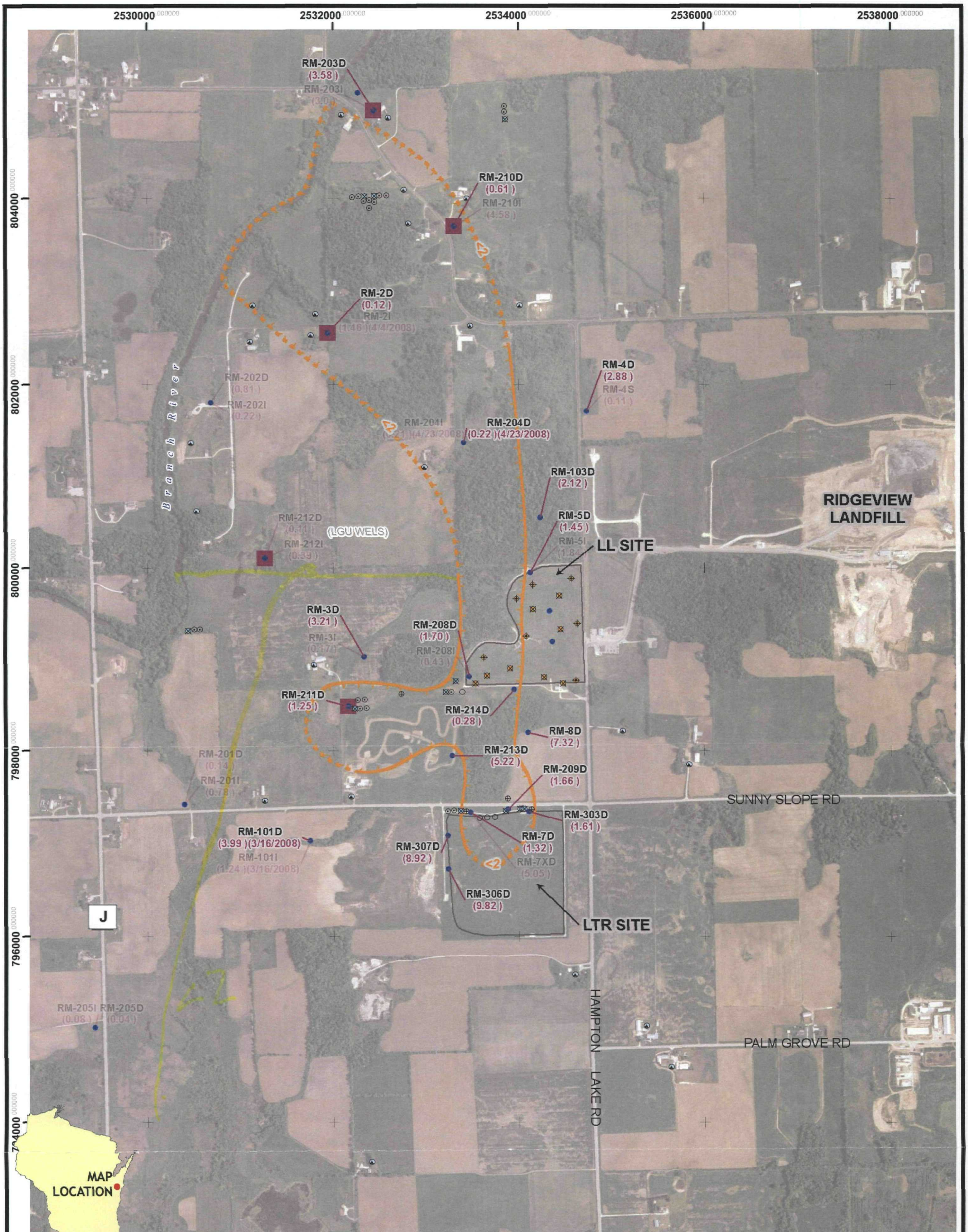

LEGEND

- MONITORING WELL (RM)
- SENTINEL WELLS

DO ISO-CONCENTRATION (MG/L)

DO SAMPLES USED FOR ISO-LINES

LABELS SHOW CONCENTRATION (MG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008. HIGHLIGHTED LABELS REPRESENT SAMPLES FROM WELLS SCREENED IN BEDROCK.

RM-208
(825.53)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. WELLS/RESULTS SHOWN IN BOLD FONT WERE USED FOR CONTOURING.
4. BEDROCK WELLS RM-205D, RM-201D AND RM-202D WERE NOT USED FOR CONTOURING BECAUSE LOWER CONCENTRATIONS OF DO AT THESE WELLS ARE NATURALLY OCCURRING.

0 1,000 FEET
1" = 1,000'
1:12,000

PROJECT:	LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN		
SHEET TITLE:	DISSOLVED OXYGEN CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008 (ISO-CONCENTRATIONS FOR BEDROCK WELLS ONLY)		
DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574613.mxd
APPROVED BY: JDW	DATE PRINTED:	FIGURE 14	
DATE: DECEMBER 2008	12/22/2008		

RMT

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P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

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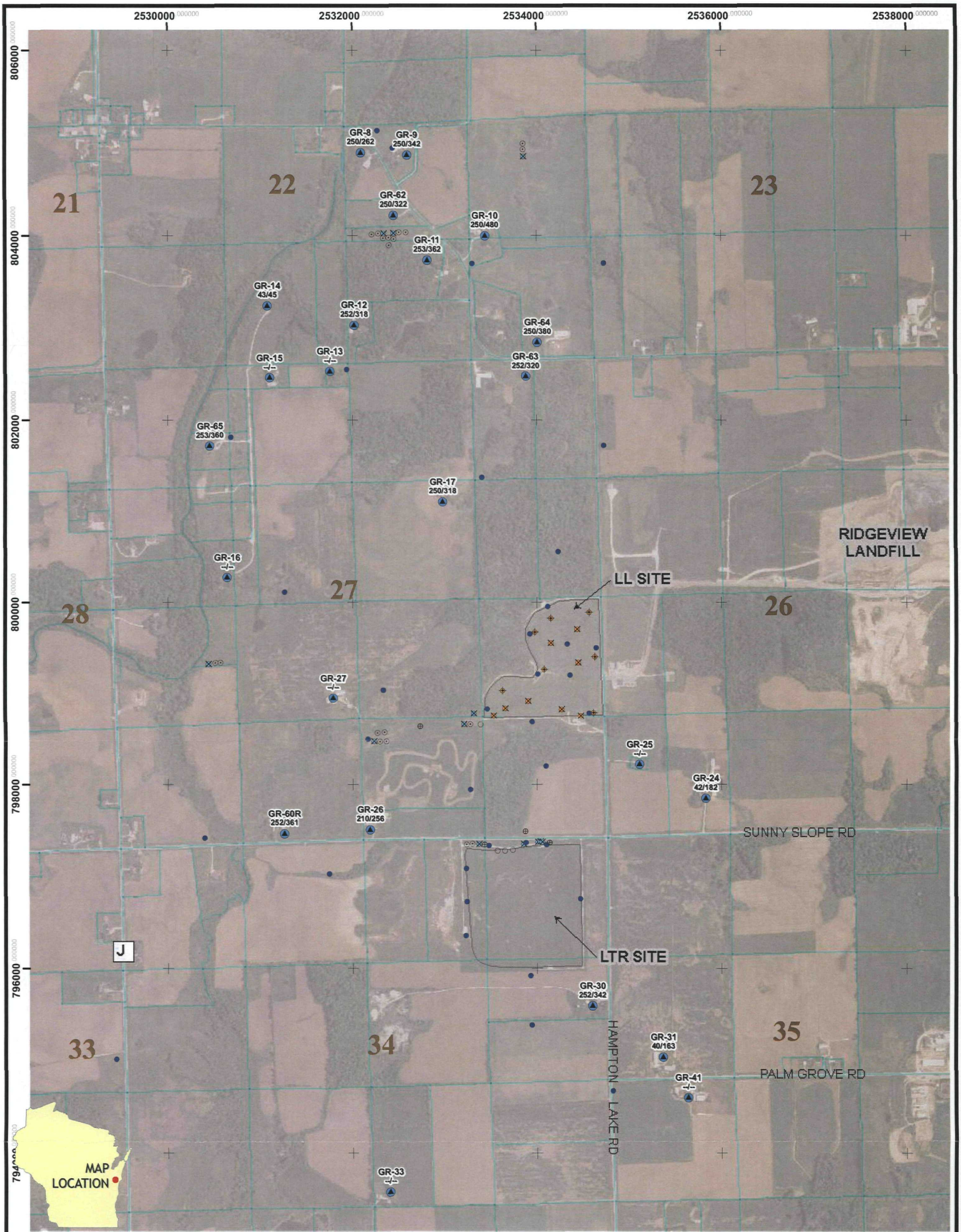

LEGEND

SAMPLE AND MONITORING LOCATIONS

- ⊕ BEDROCK BORING
- ○ GW COLLECTION SUMP (GWC)
- ✕ GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- ✕ LEACHATE HEAD WELL (LH)
- ✦ LEACHATE WITHDRAWL WELL (LW)
- ● MONITORING WELL (RM)

RM-203D SENTINEL WELLS

RM-303D NEAR FIELD WELLS DESIGNATED FOR QUARTERLY SAMPLING

PROPERTY BOUNDARIES

LANDFILL AREA

210/256 RESIDENTIAL WELL (GW) SHOWING **CASING DEPTH / TOTAL DEPTH** (FEET) WHERE KNOWN

0 1,000 FEET

1" = 1,000'

1:12,000

N

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.

PROJECT:	**LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**		
SHEET TITLE:	**RESIDENTIAL WELL LOCATIONS AND CASING DEPTHS**		
DRAWN BY: HANKLEY C	SCALE:	PROJ. NO.	00-03456.46
CHECKED BY: LJB	AS NOTED	FILE NO.	34574614.mxd
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	**FIGURE 15**	
DATE: DECEMBER 2008			

RMT

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Phone: 608-831-4444
Fax: 608-831-3334

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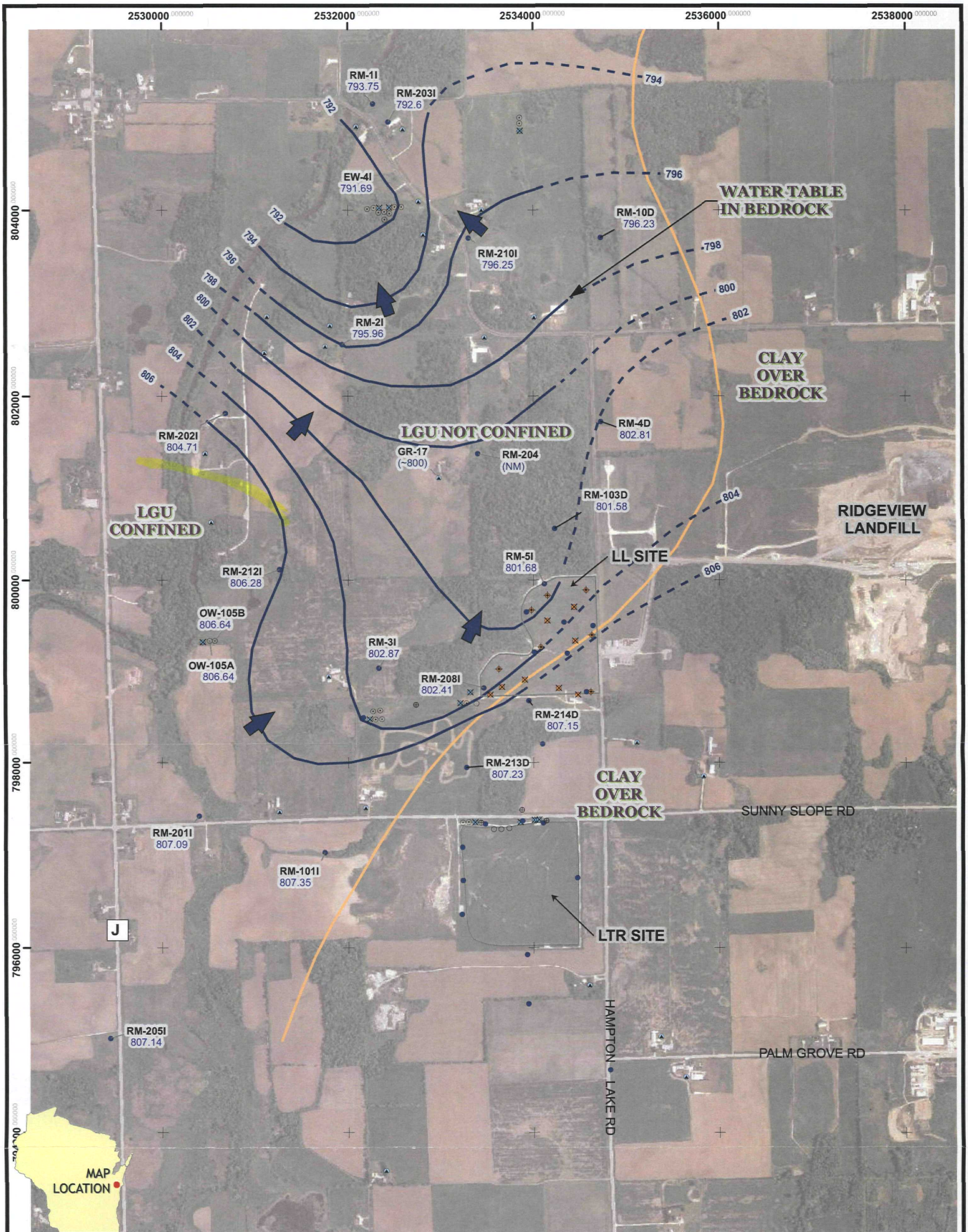
Appendix A
Deep Well Installation Documentation - December 12, 2008, Letter

Appendix B
LGU Potentiometric Surface - July 2008



LEGEND

SAMPLE AND MONITORING LOCATIONS

- ⊕ BEDROCK BORING
- ○ GW COLLECTION SUMP (GWC)
- ✖ GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- ✖ LEACHATE HEAD WELL (LH)
- ✦ LEACHATE WITHDRAWL WELL (LW)
- ● MONITORING WELL (RM)
- ▲ RESIDENTIAL WELL (GW)

WATER TABLE ELEVATION CONTOUR (IN BEDROCK)

LGU POTENTIOMETRIC SURFACE ELEVATION CONTOUR

LGU ABSENT EAST OF LINE

ELEVATION CONTOURS IN FT MSL.
2 FT CONTOUR INTERVAL
(DASHED WHERE INFERRED)

806

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. WATER ELEVATIONS MEASURED JULY 3, 2008.
3. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.

N

0 1,000 FEET
1" = 1,000'
1:12,000

PROJECT:	LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN		
SHEET TITLE:	LGU POTENTIOMETRIC SURFACE JULY 2008		
DRAWN BY: BENTON K	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574605.mxd
APPROVED BY: JDW	DATE PRINTED: 12/23/2008	FIGURE B-1	
DATE: DECEMBER 2008			

RMT

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P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

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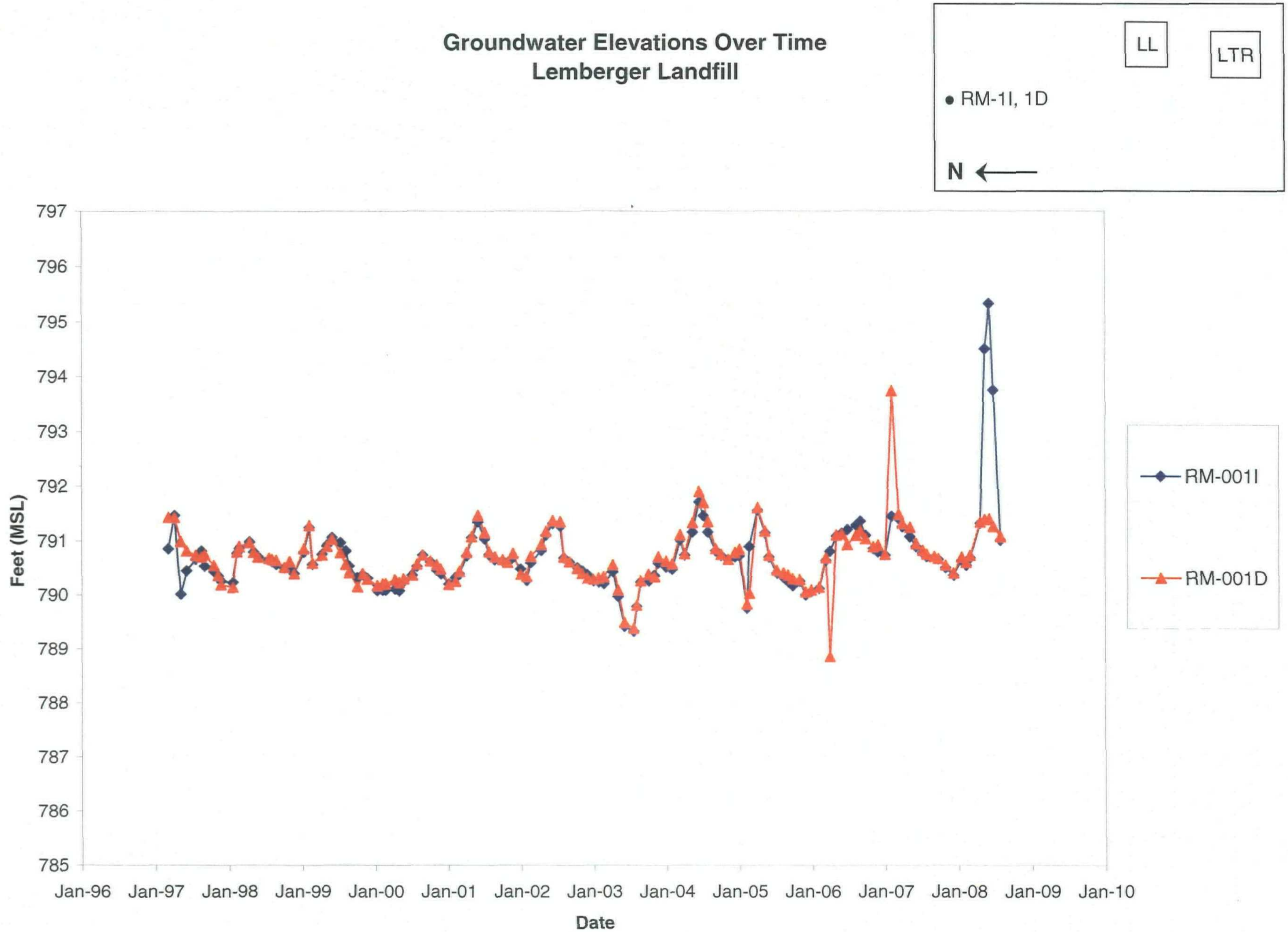
Appendix C
Hydrographs



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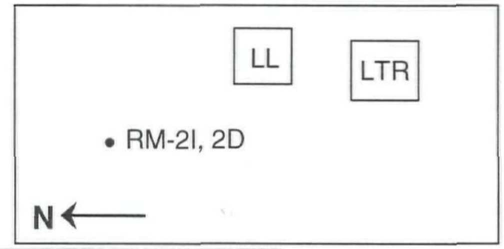
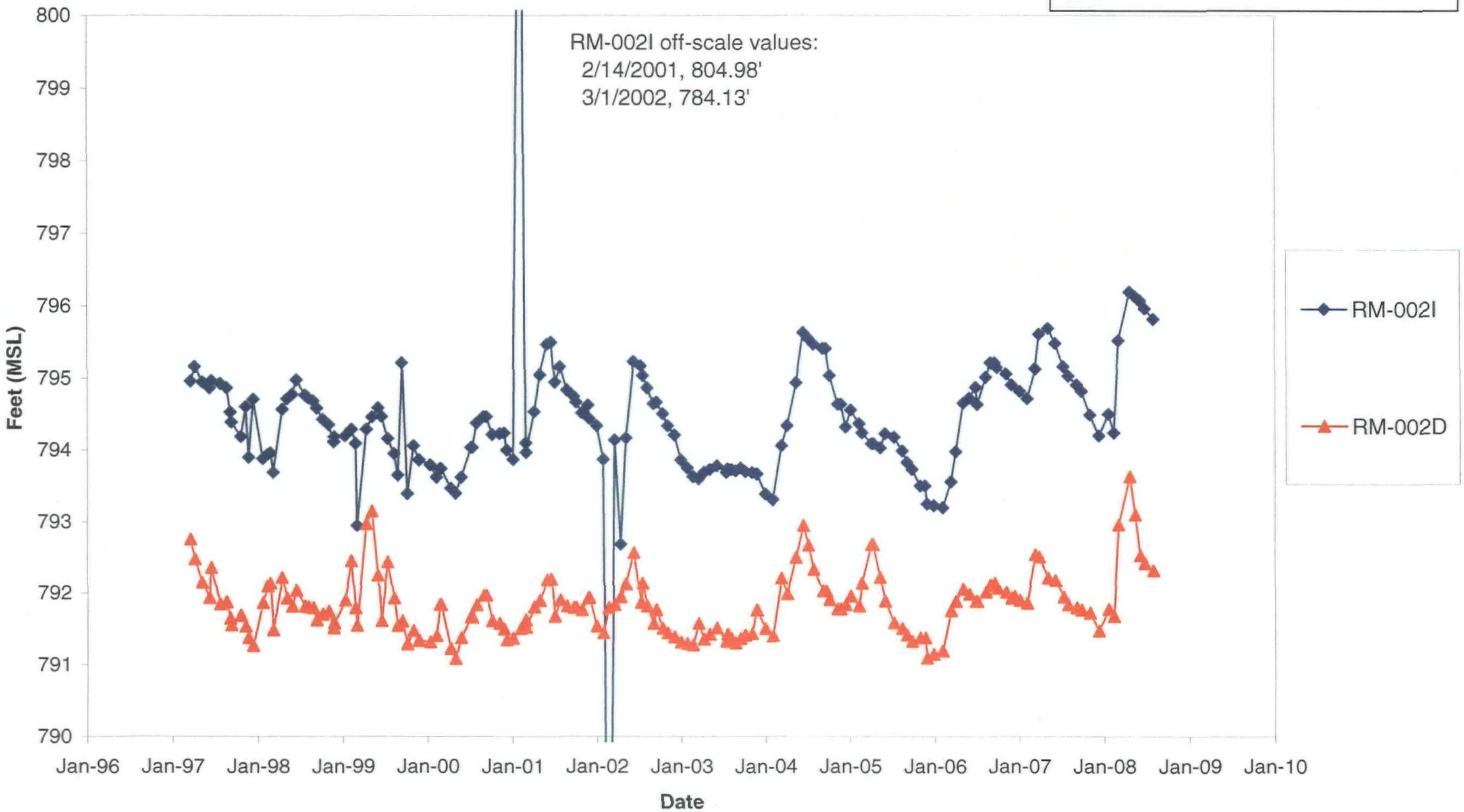
Groundwater Elevations Over Time
Lemberger Landfill





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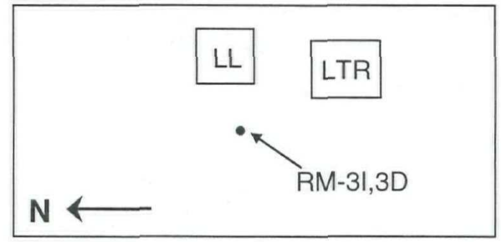
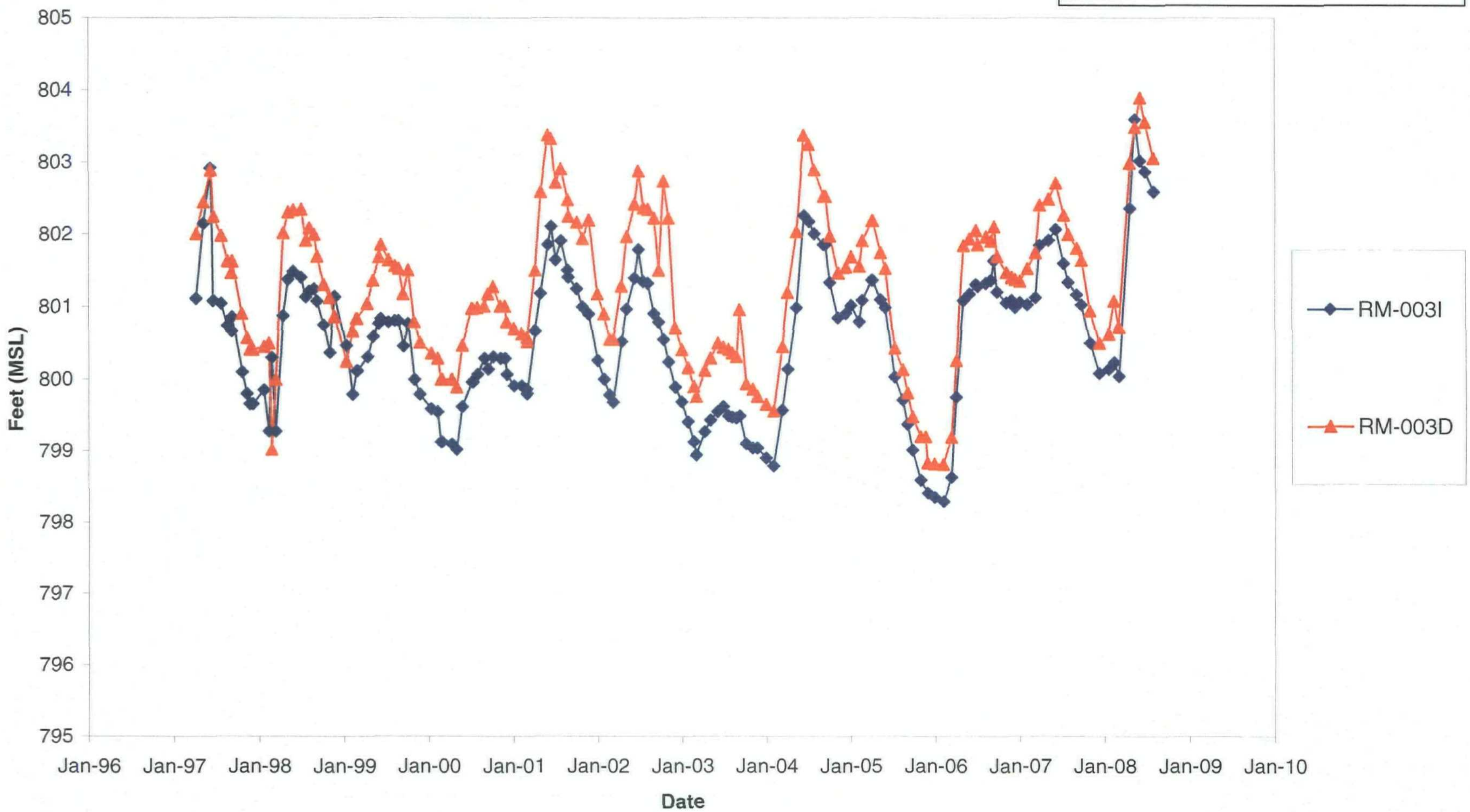
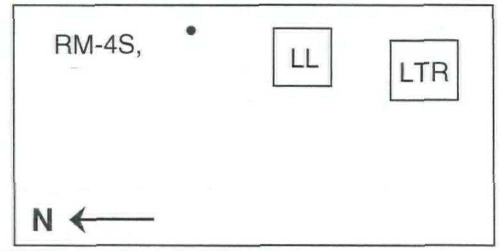
Groundwater Elevations Over Time
Lemberger Landfill

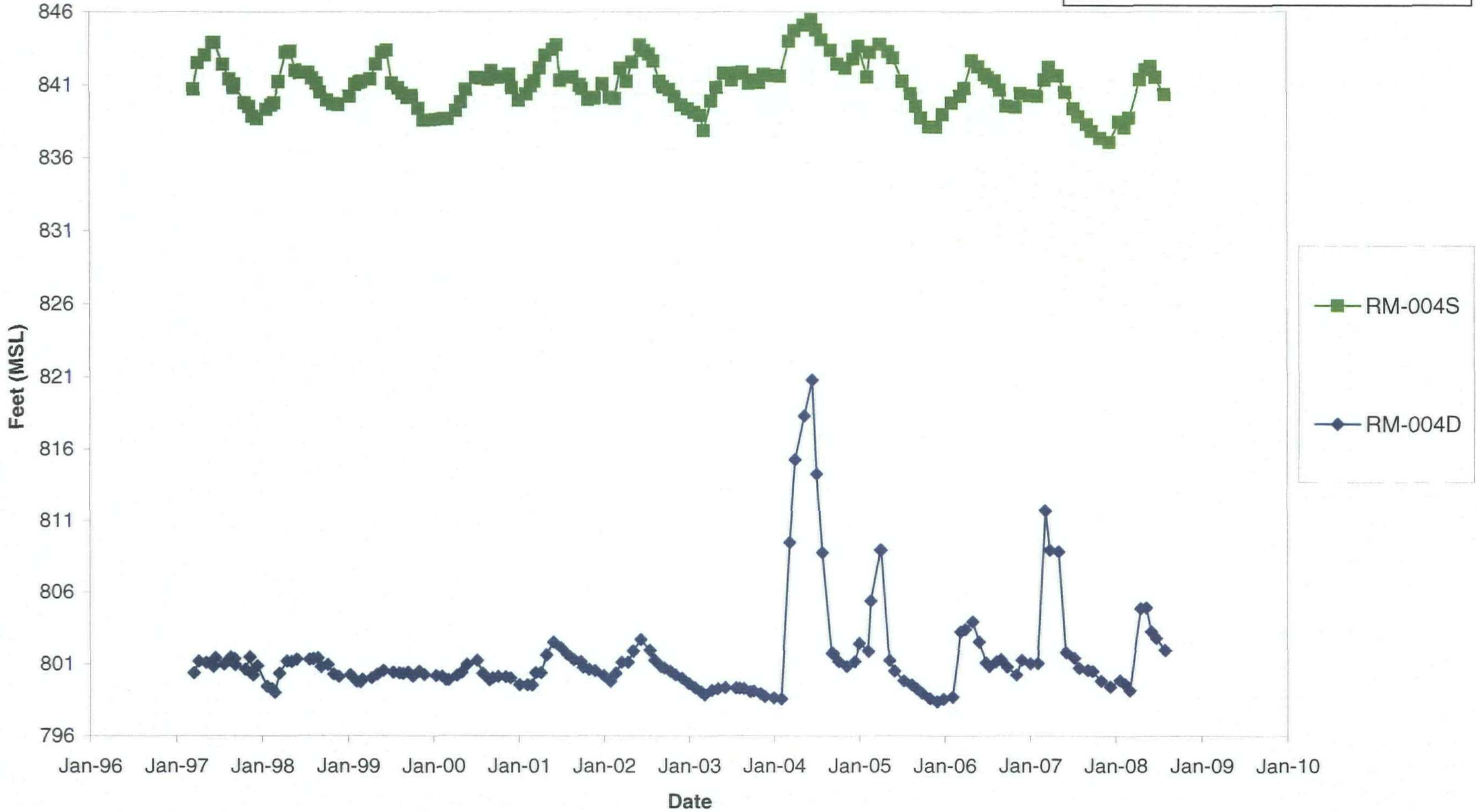




3

Groundwater Elevations Over Time
Lemberger Landfill





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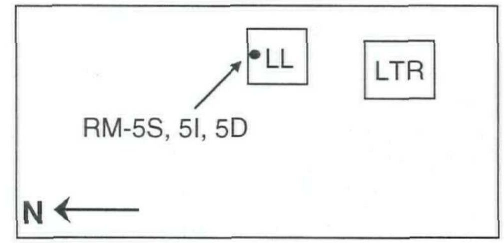
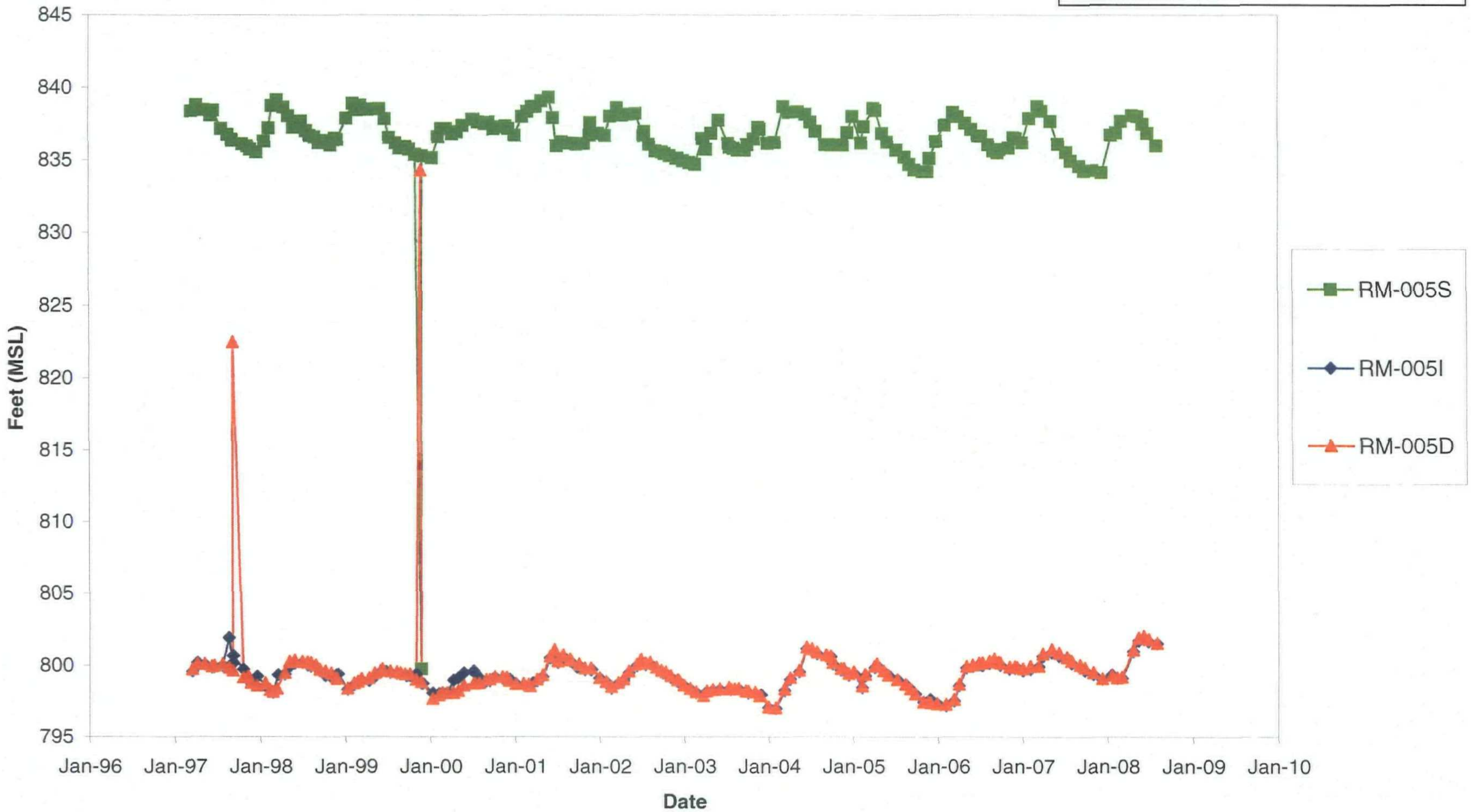
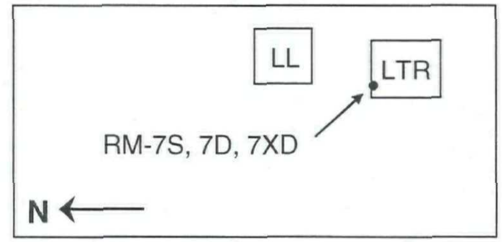
Groundwater Elevations Over Time
Lemberger Landfill

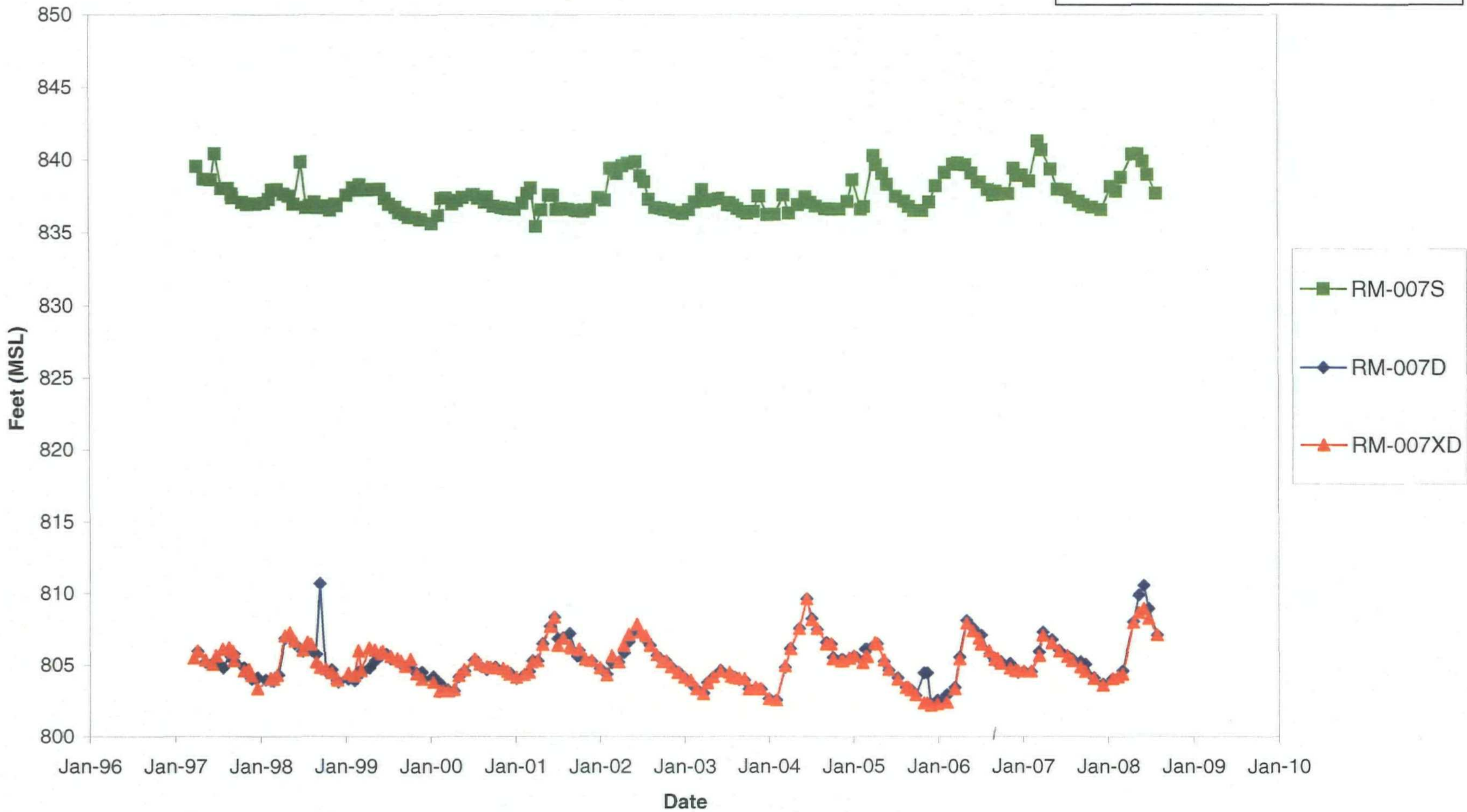




5

Groundwater Elevations Over Time
Lemberger Landfill





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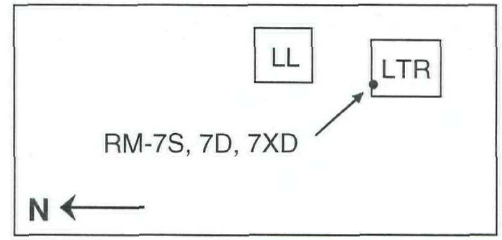
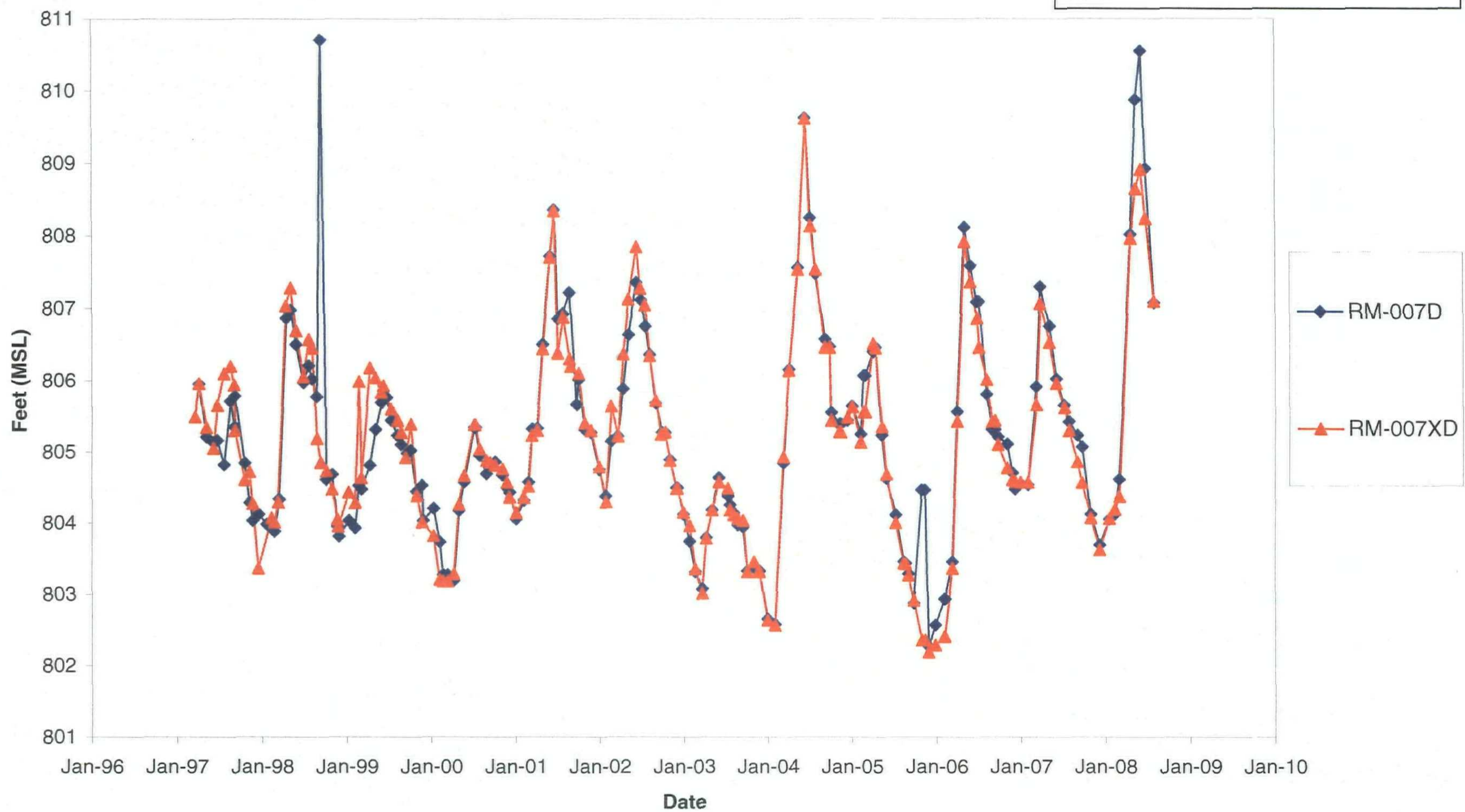
Groundwater Elevations Over Time
Lemberger Landfill





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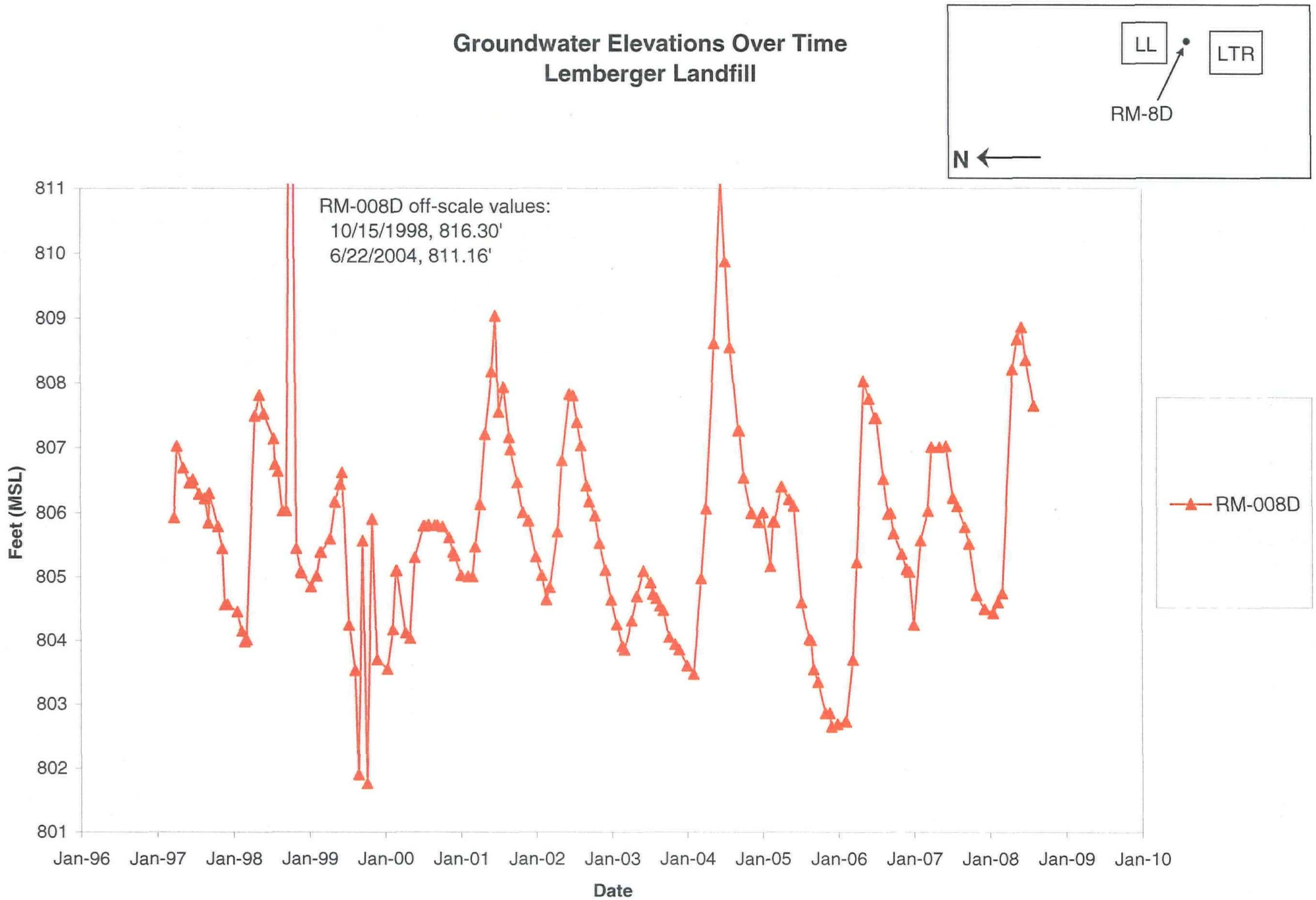

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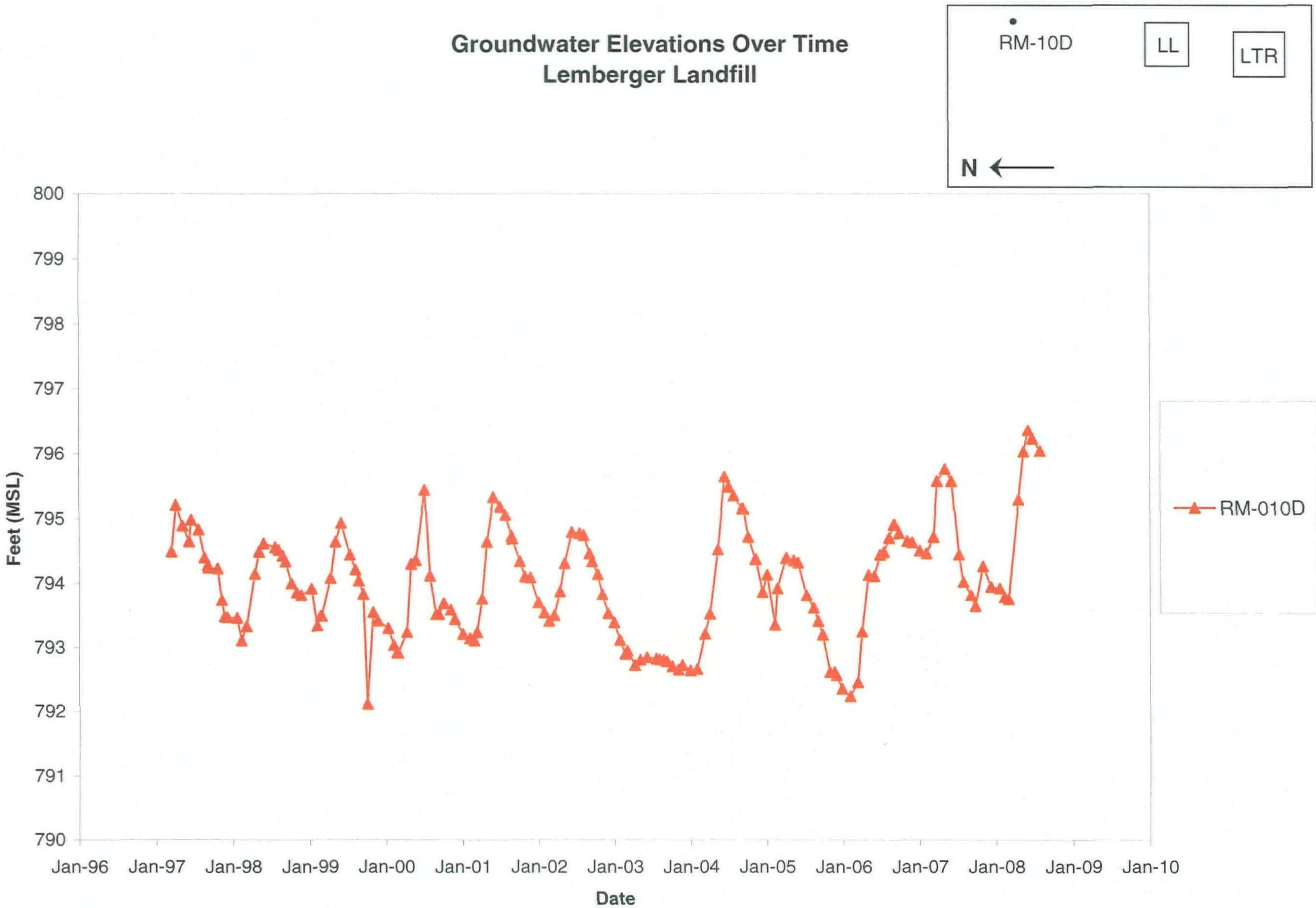

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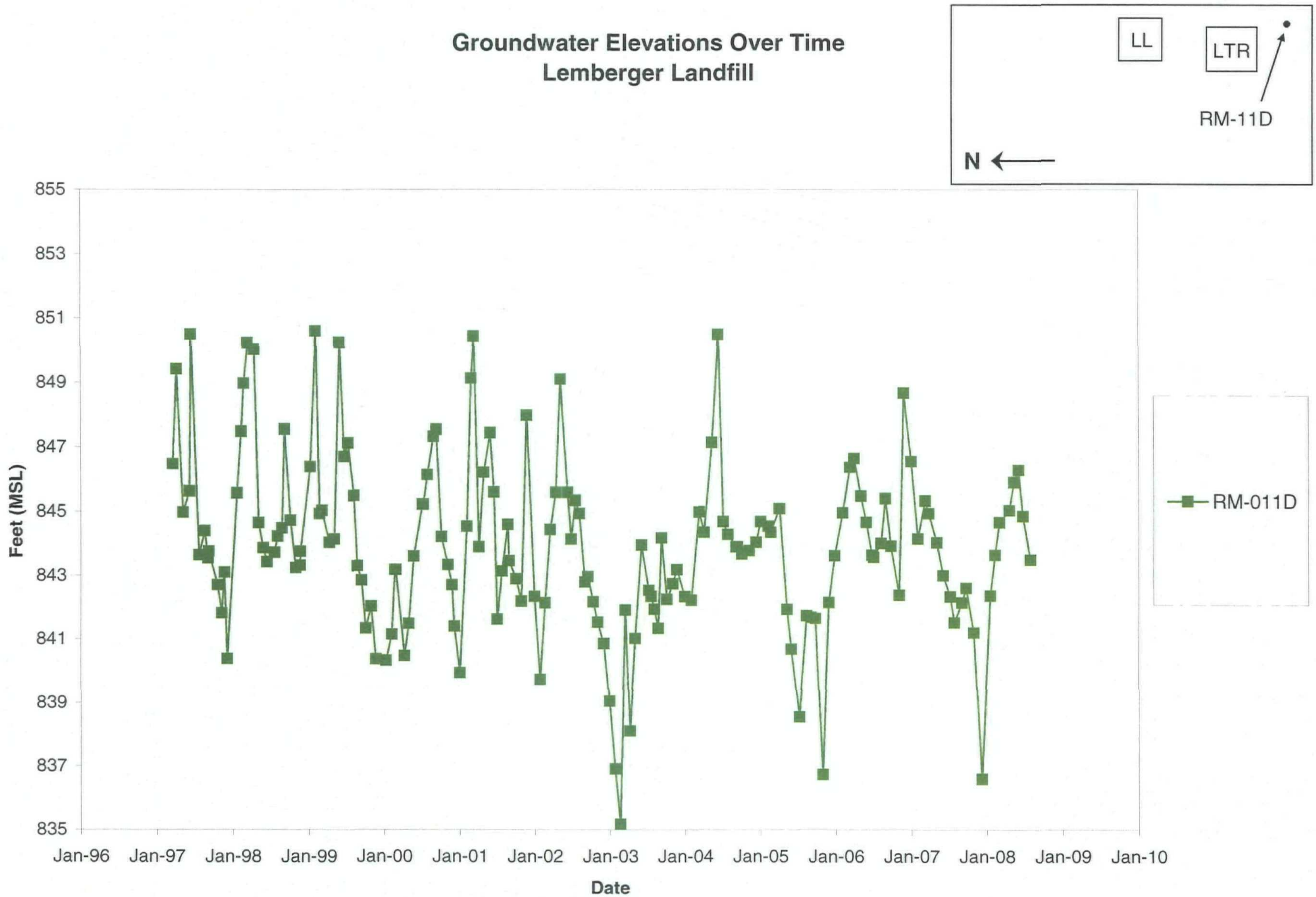

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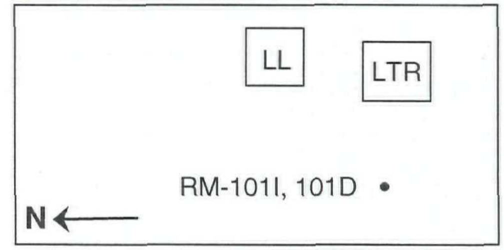
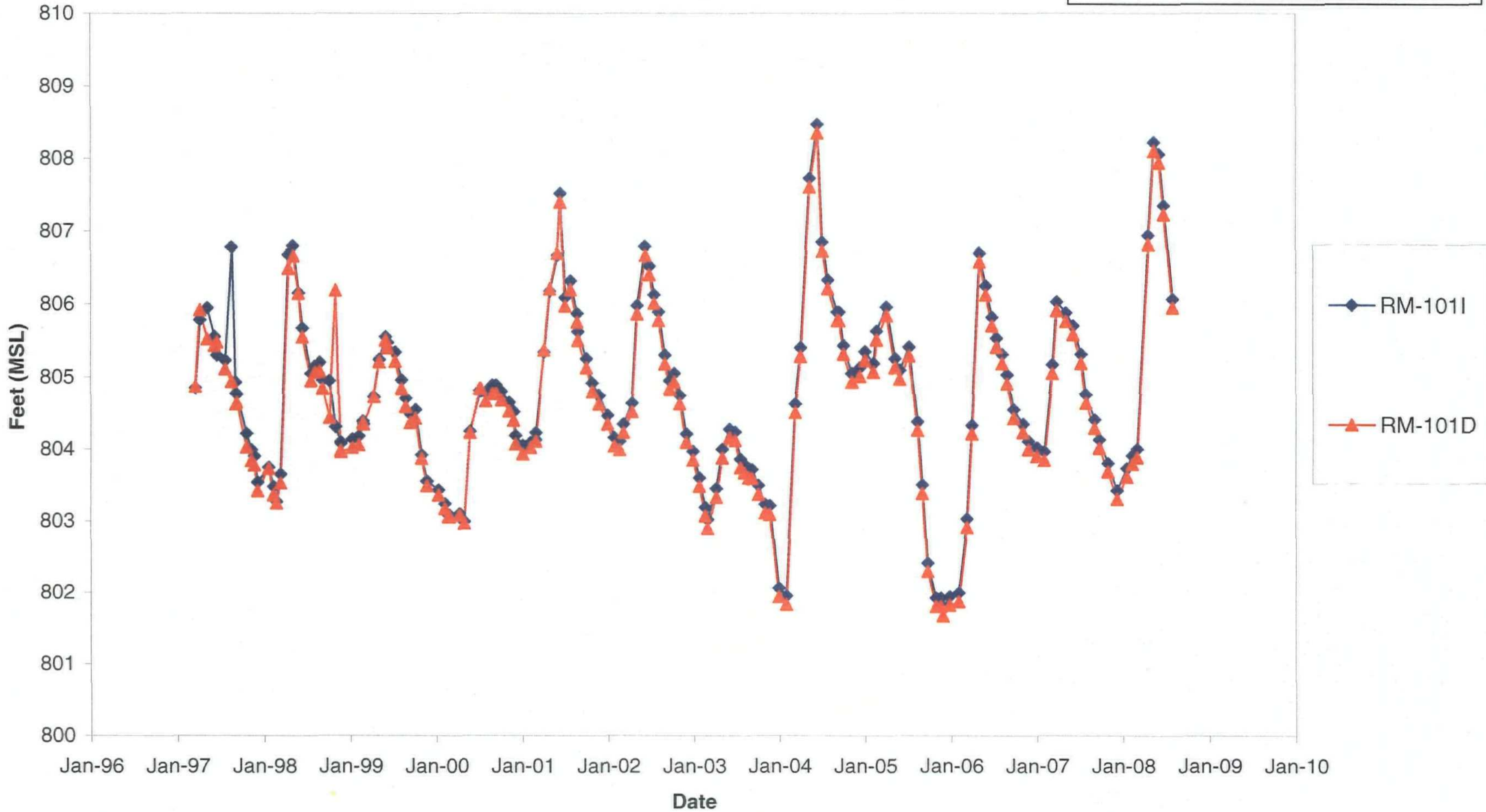
Groundwater Elevations Over Time
Lemberger Landfill





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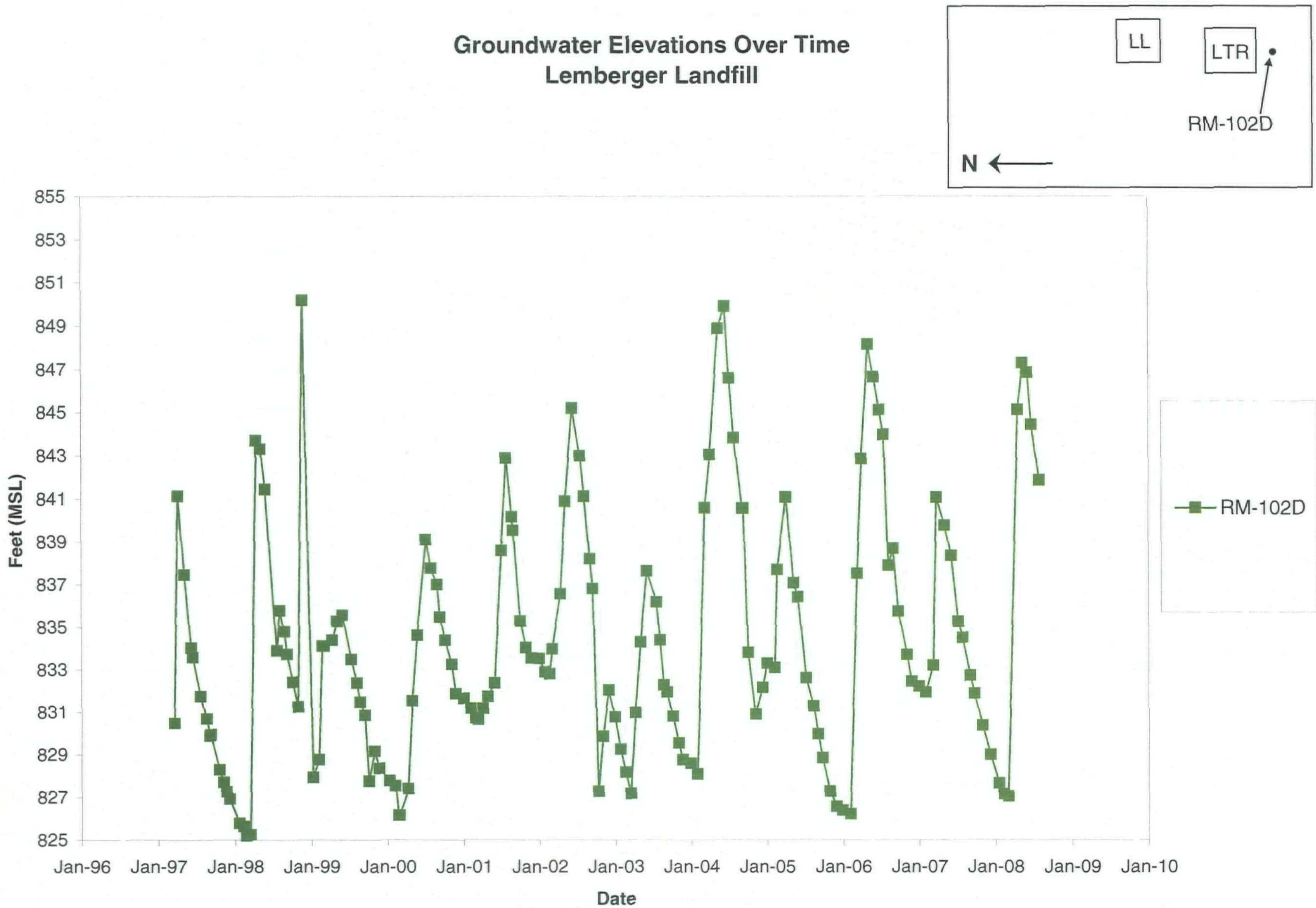
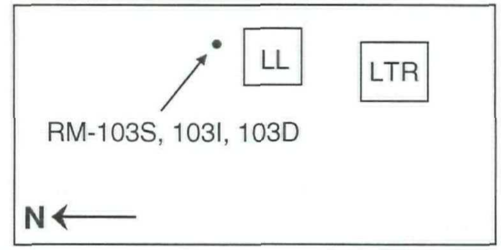
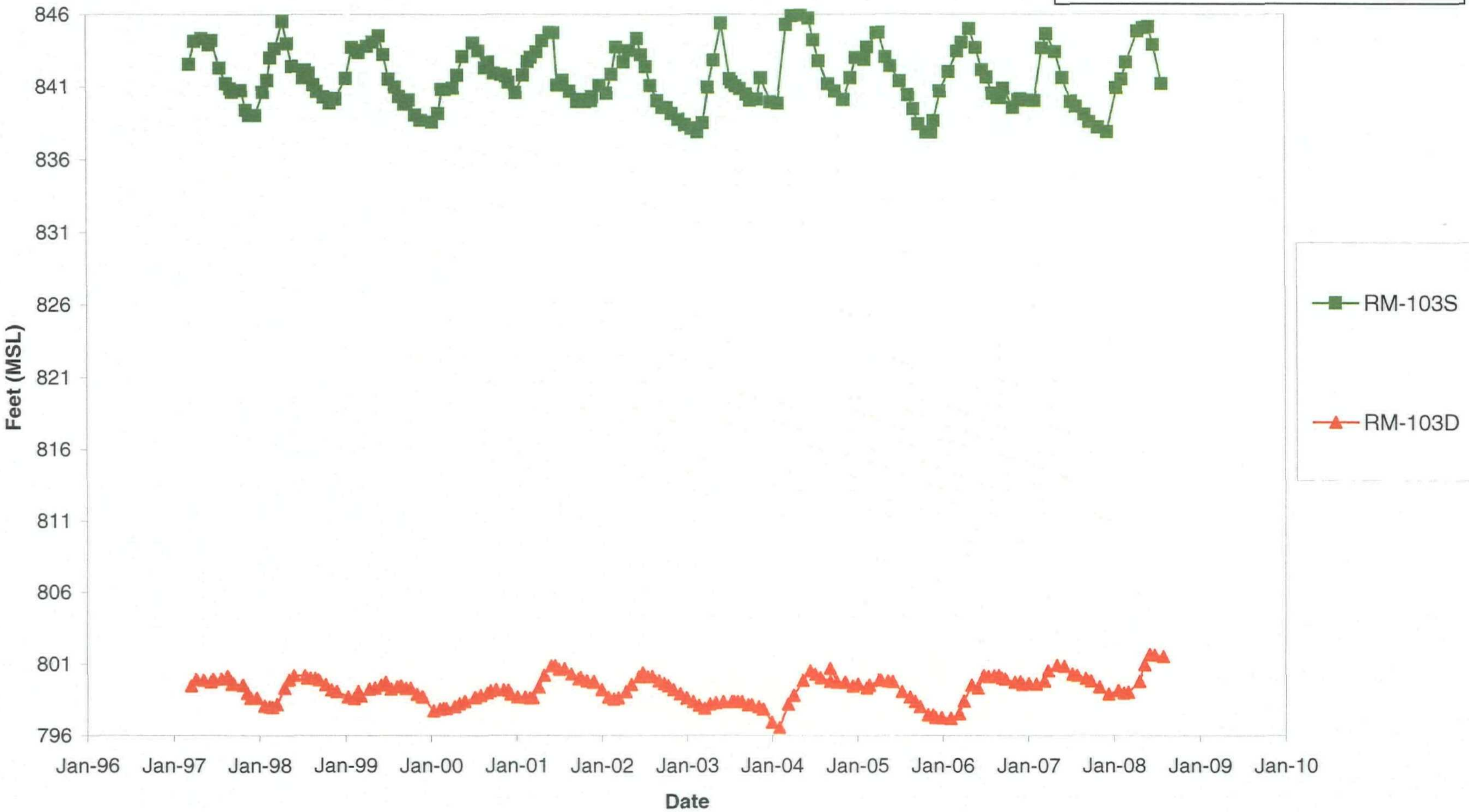
Groundwater Elevations Over Time
Lemberger Landfill



12

Groundwater Elevations Over Time
Lemberger Landfill





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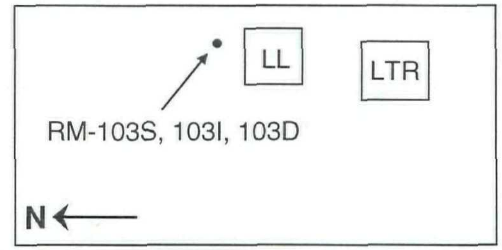
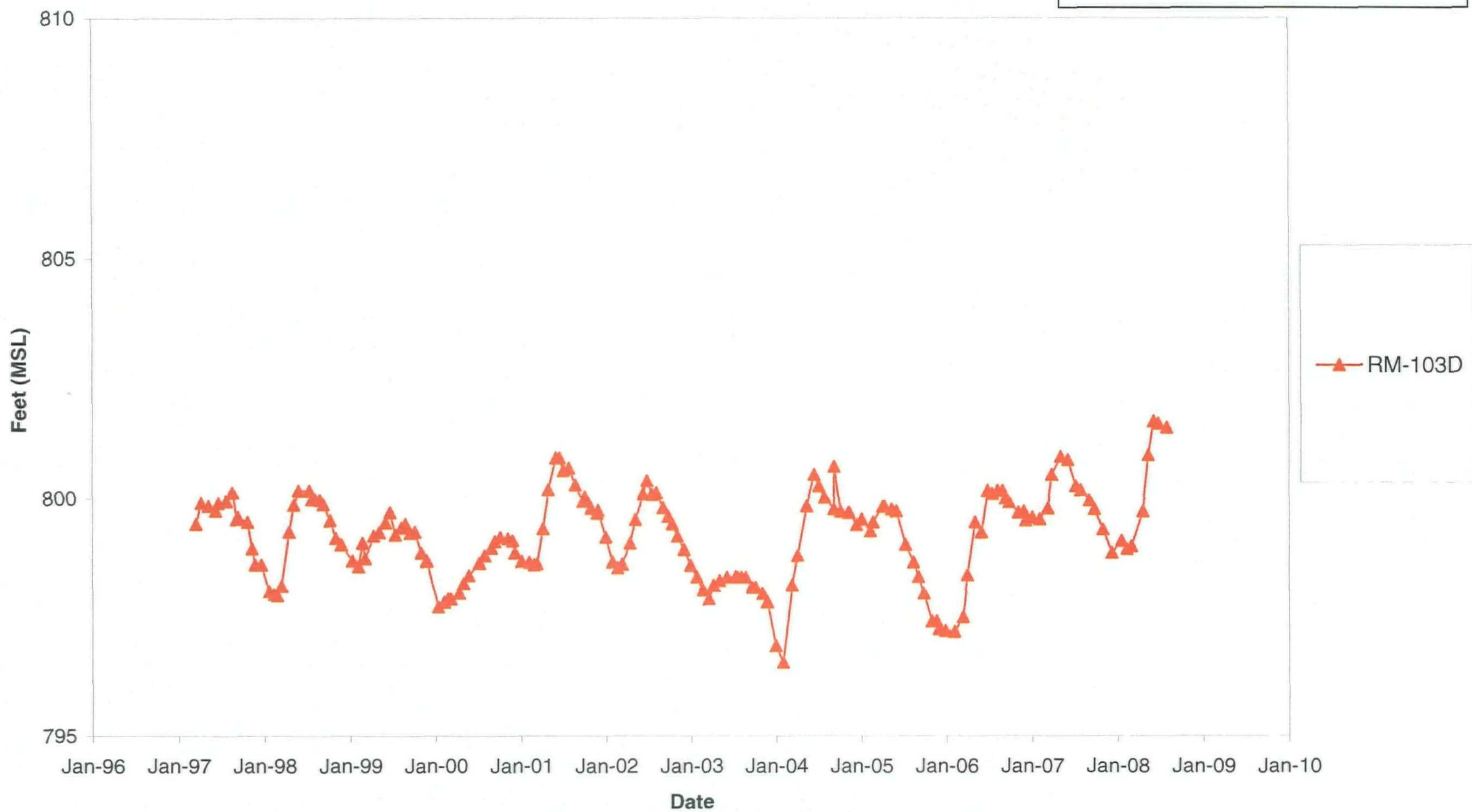
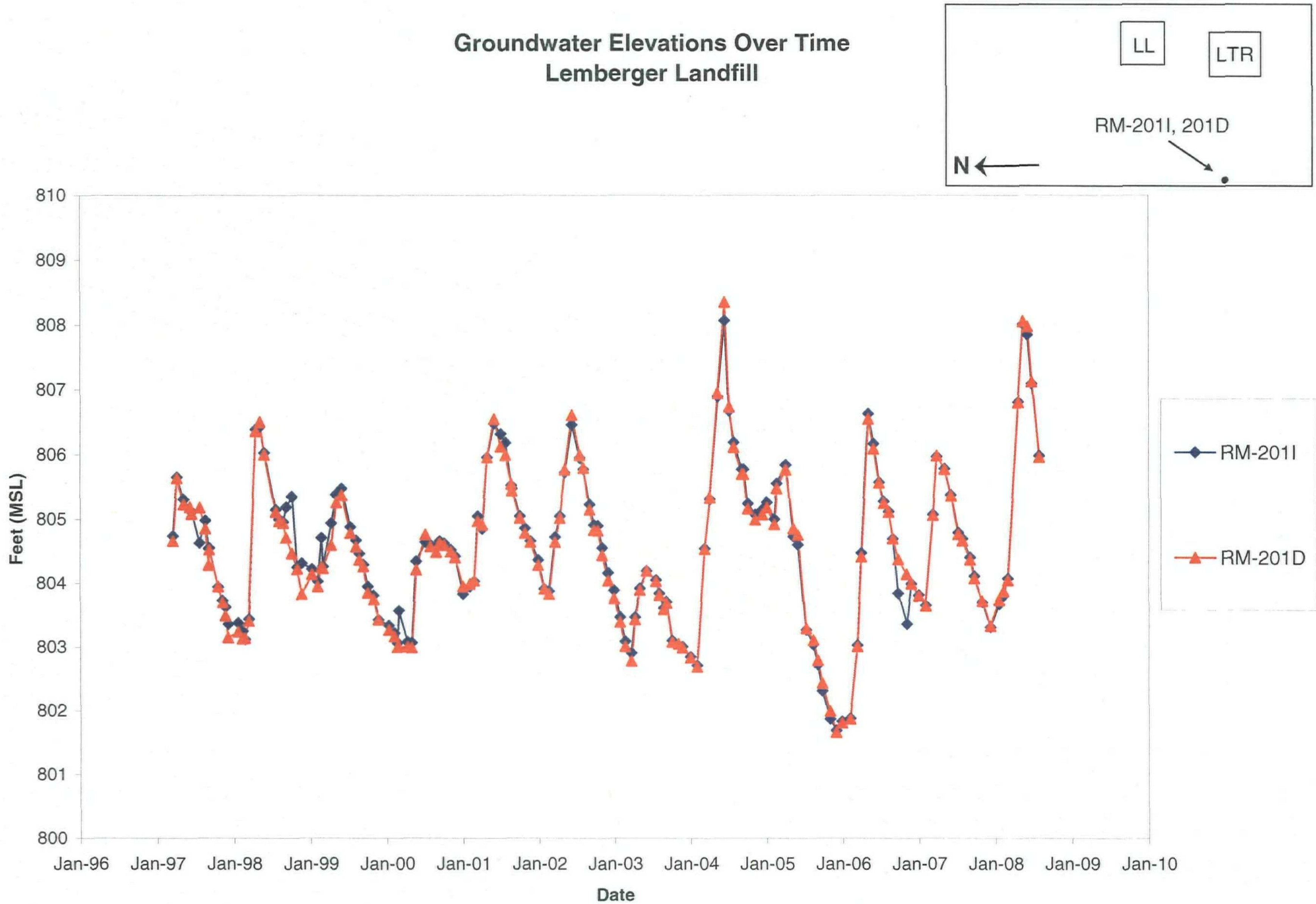
Groundwater Elevations Over Time
Lemberger Landfill

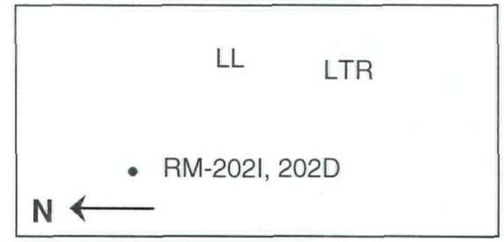


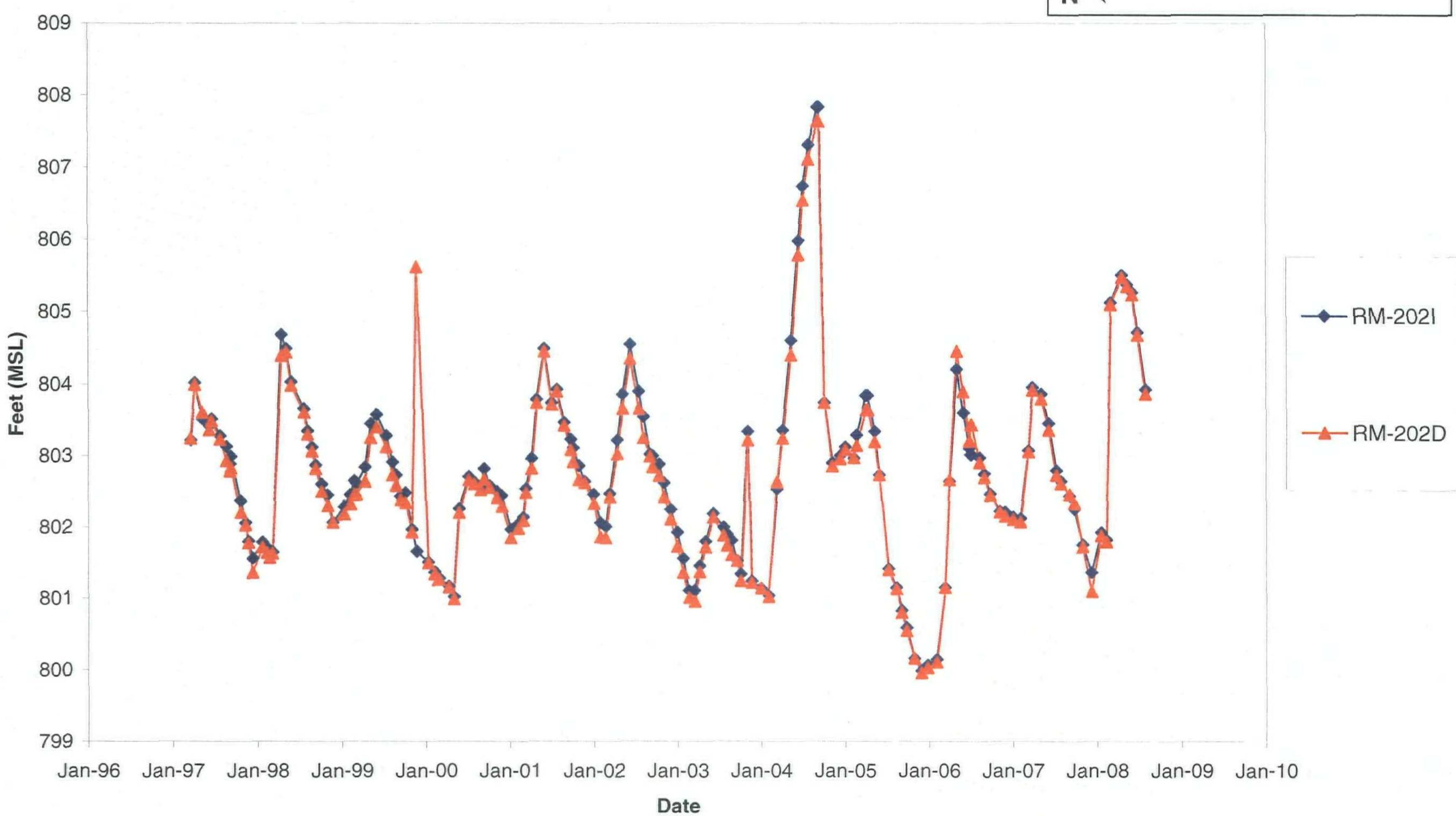



Groundwater Elevations Over Time
Lemberger Landfill
LL
LTR
RM-201I, 201D
N
810
809
808
807
806
805
804
803
802
801
800
Feet (MSL)
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Date
RM-201I
RM-201D

5

Groundwater Elevations Over Time
Lemberger Landfill





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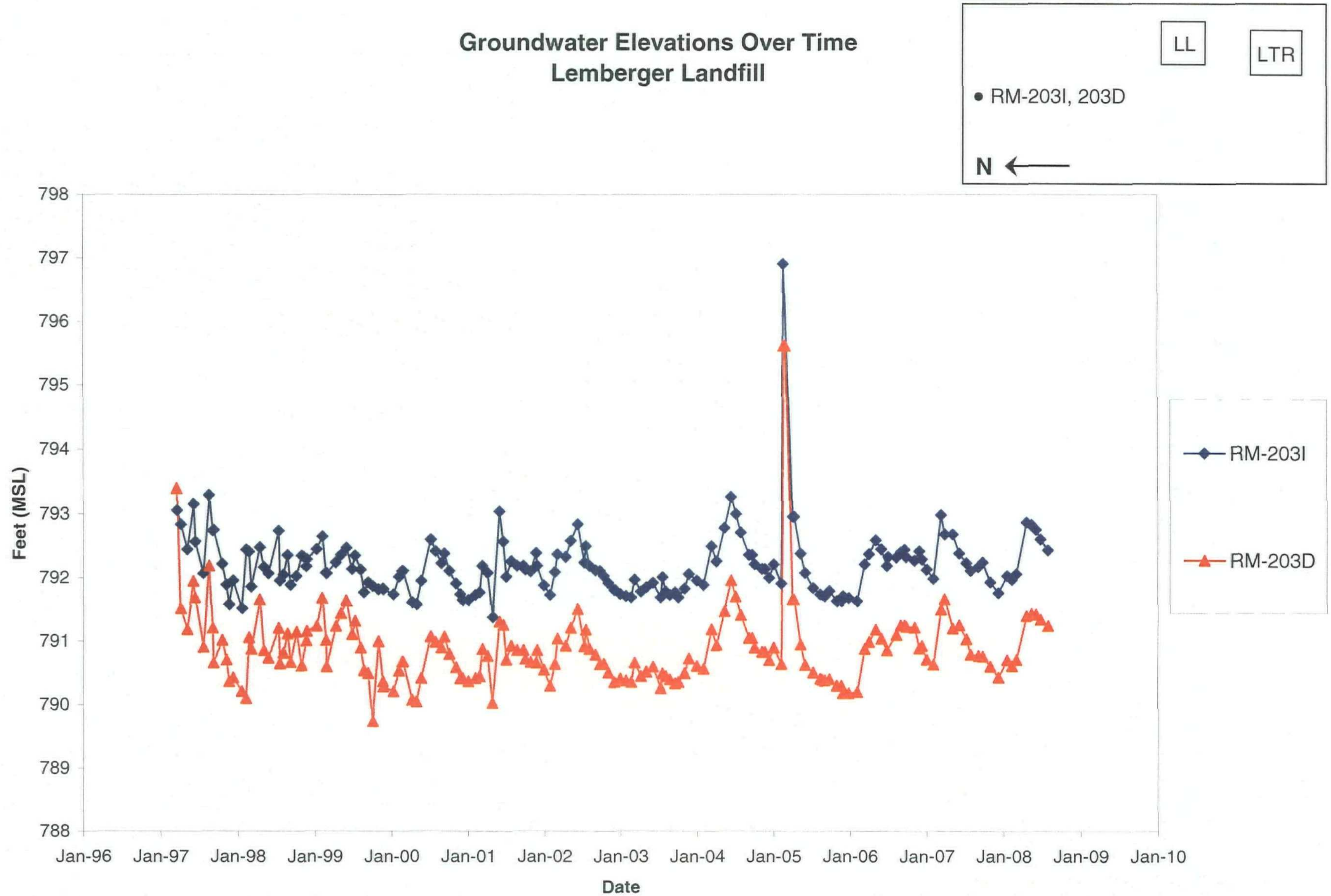

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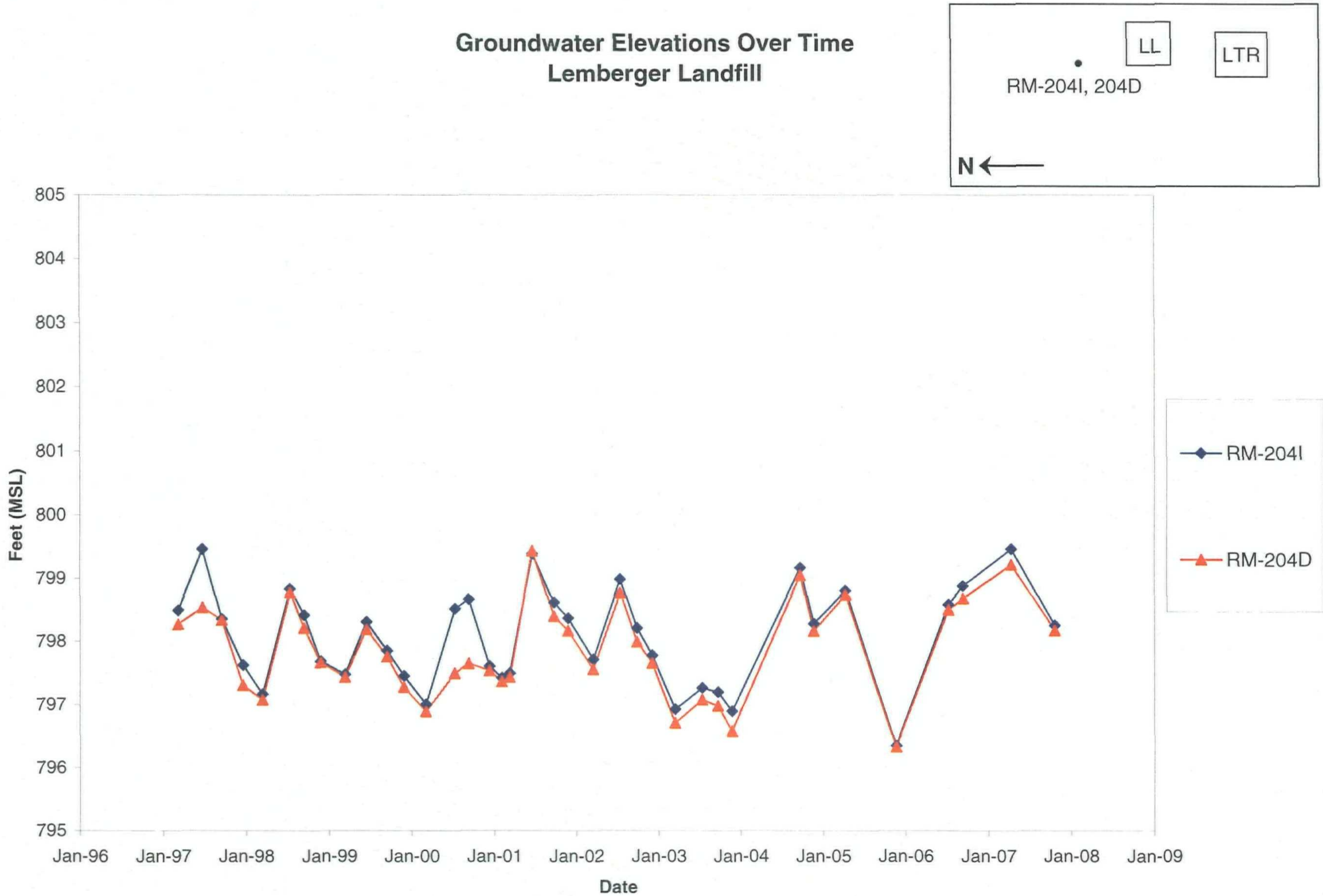
Groundwater Elevations Over Time
Lemberger Landfill



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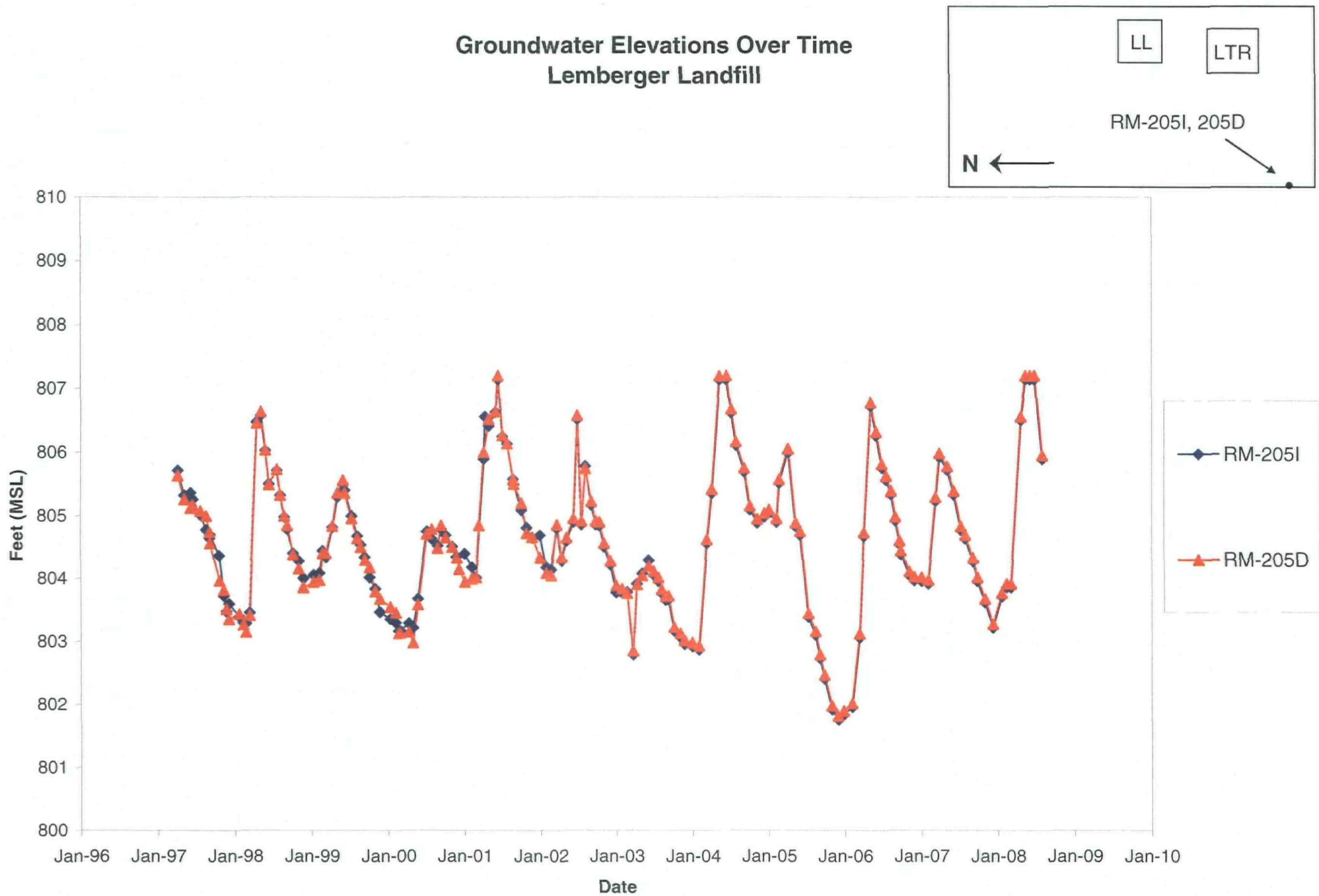
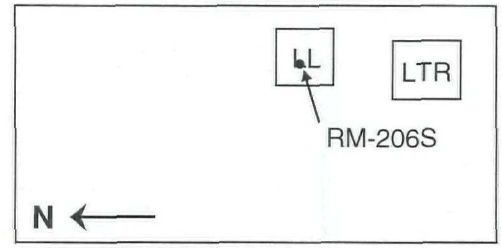
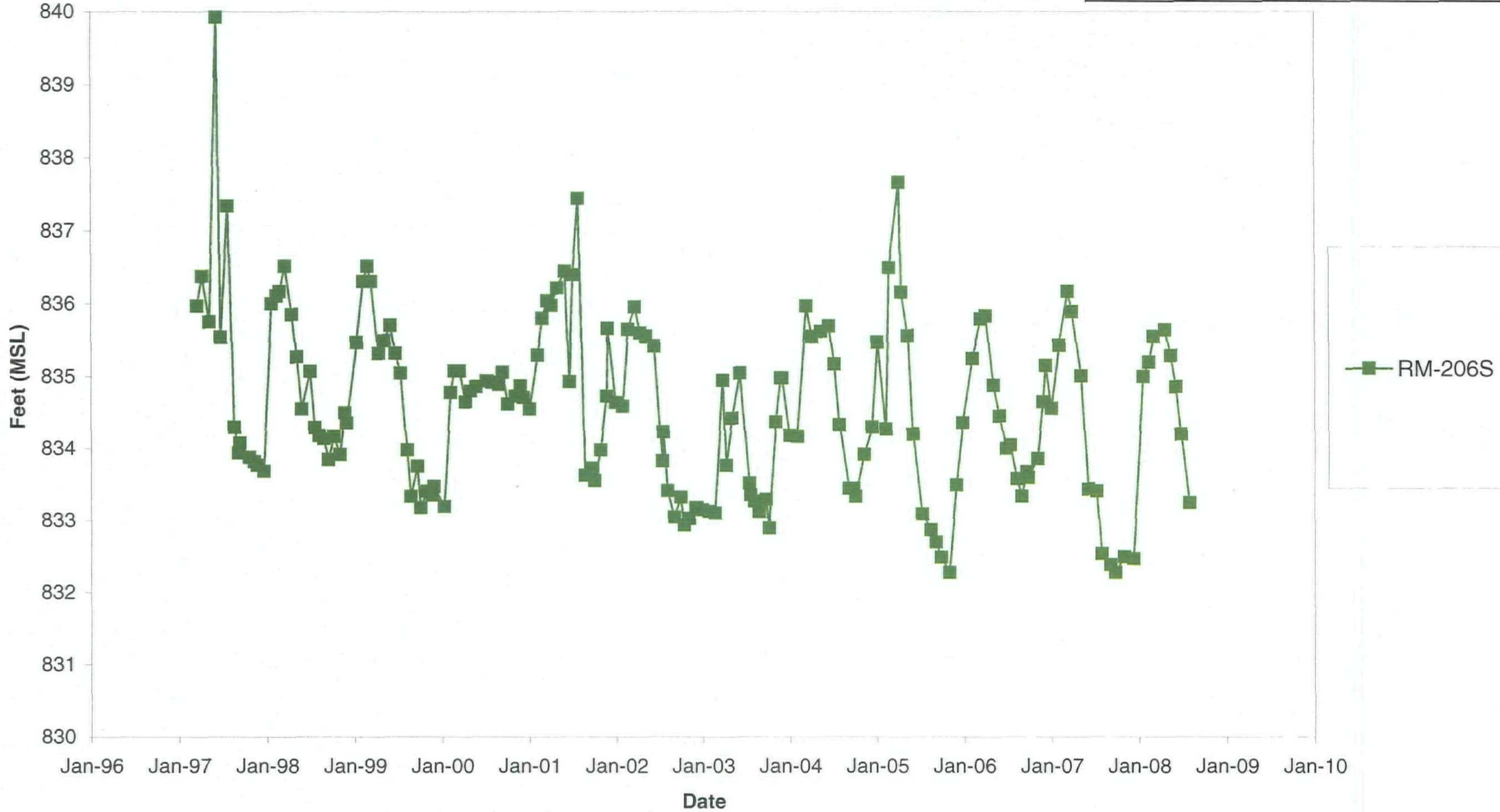

Groundwater Elevations Over Time
Lemberger Landfill
LL
LTR
RM-205I, 205D
N
810
809
808
807
806
805
804
803
802
801
800
Feet (MSL)
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Date
RM-205I
RM-205D

Groundwater Elevations Over Time
Lemberger Landfill





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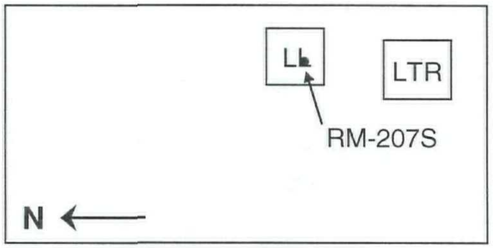
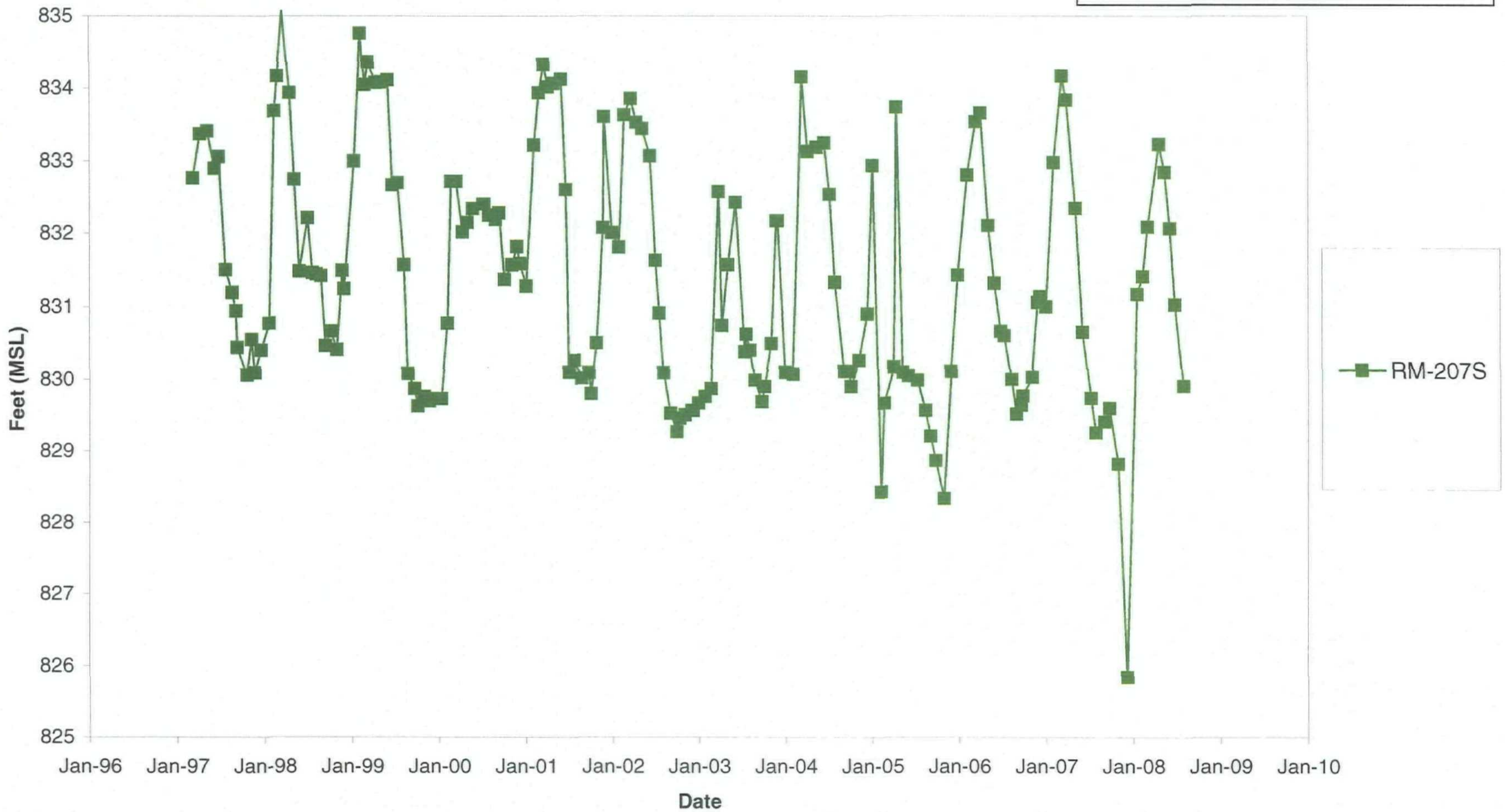
Groundwater Elevations Over Time
Lemberger Landfill





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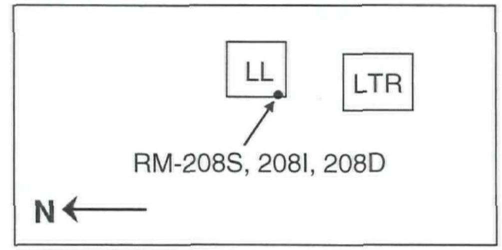
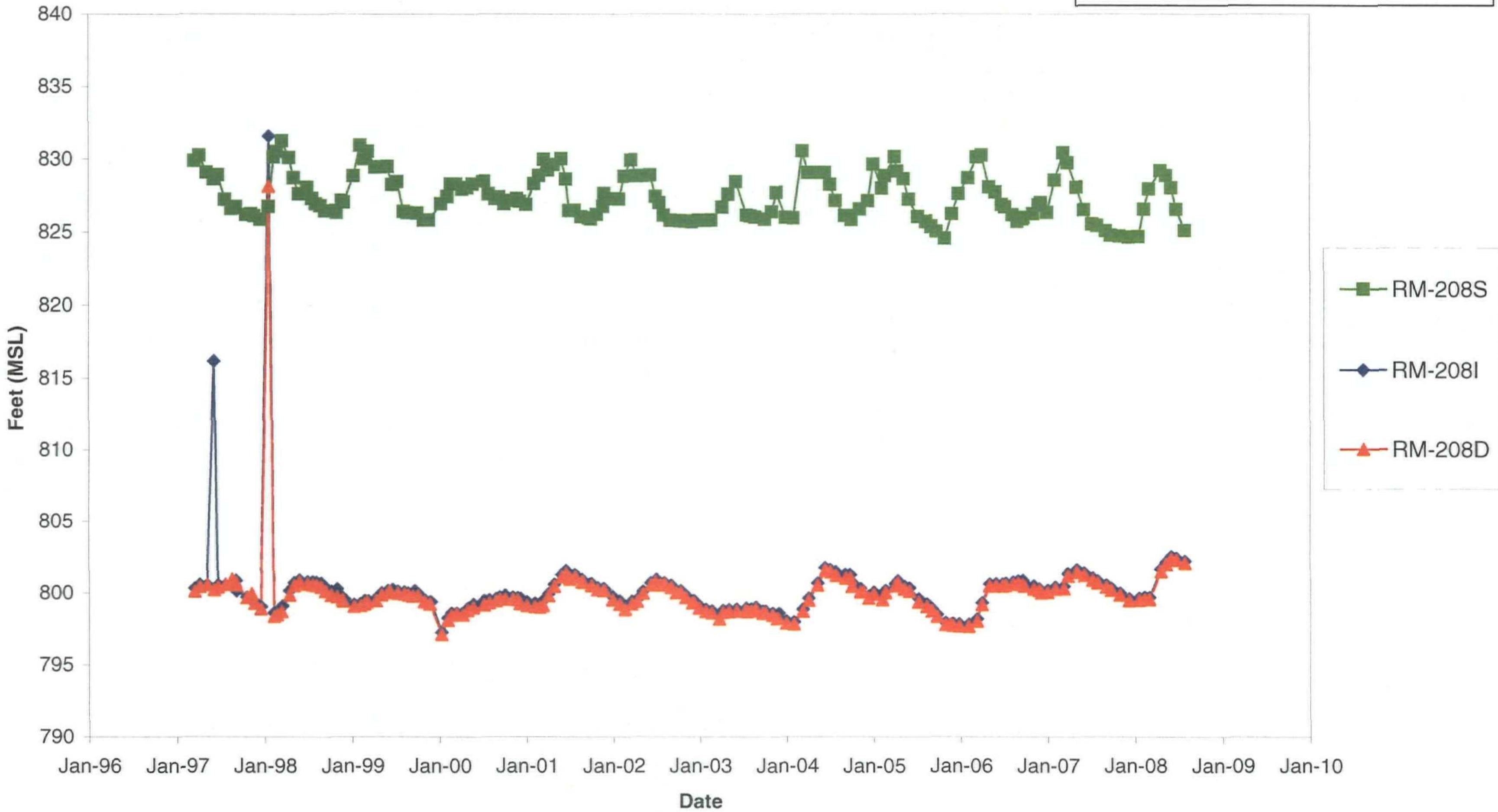
Groundwater Elevations Over Time
Lemberger Landfill





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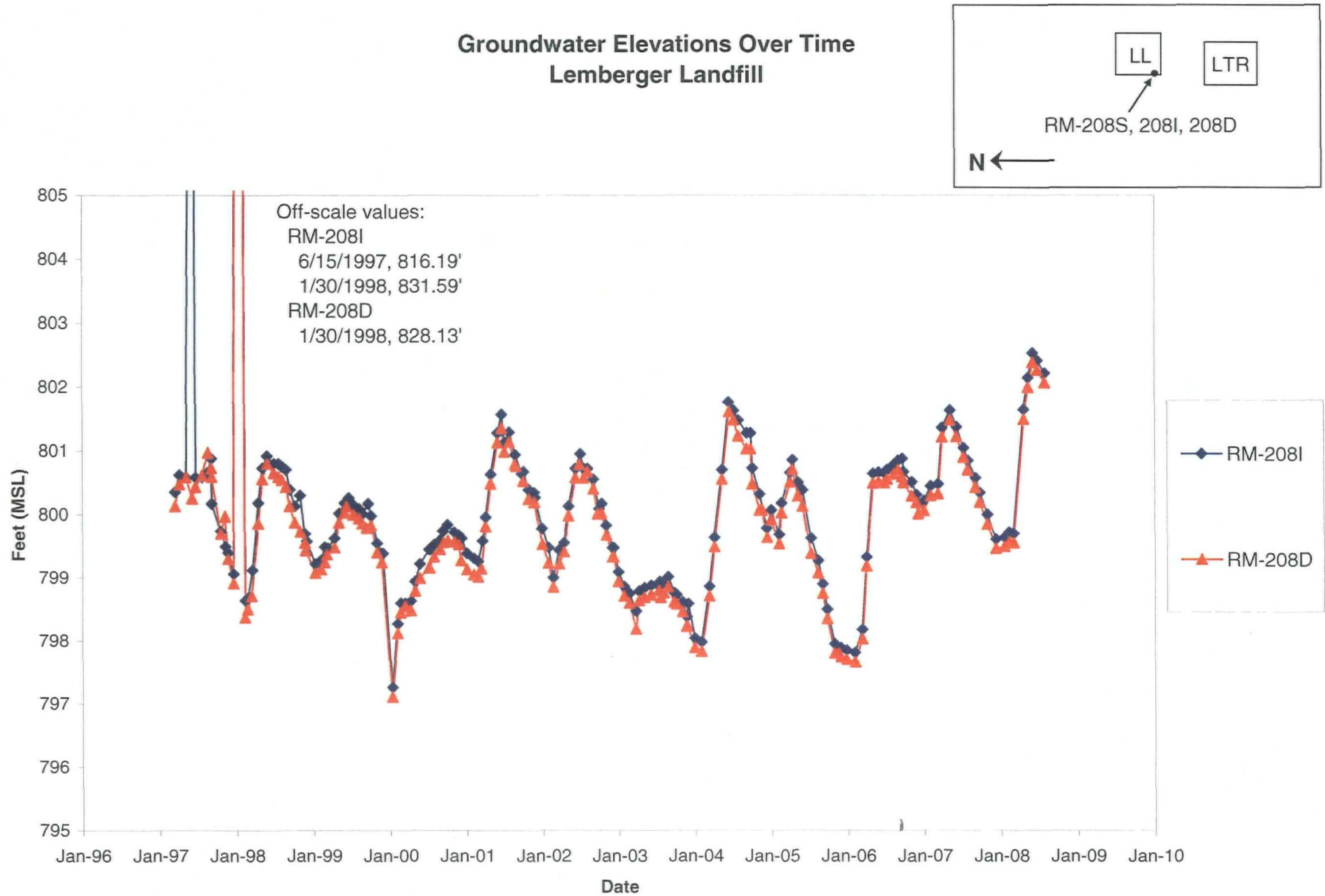

23

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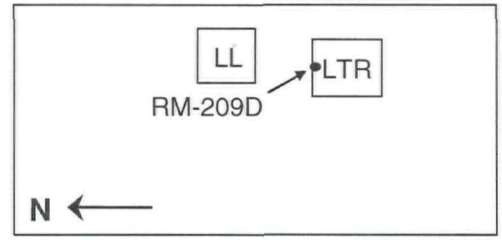
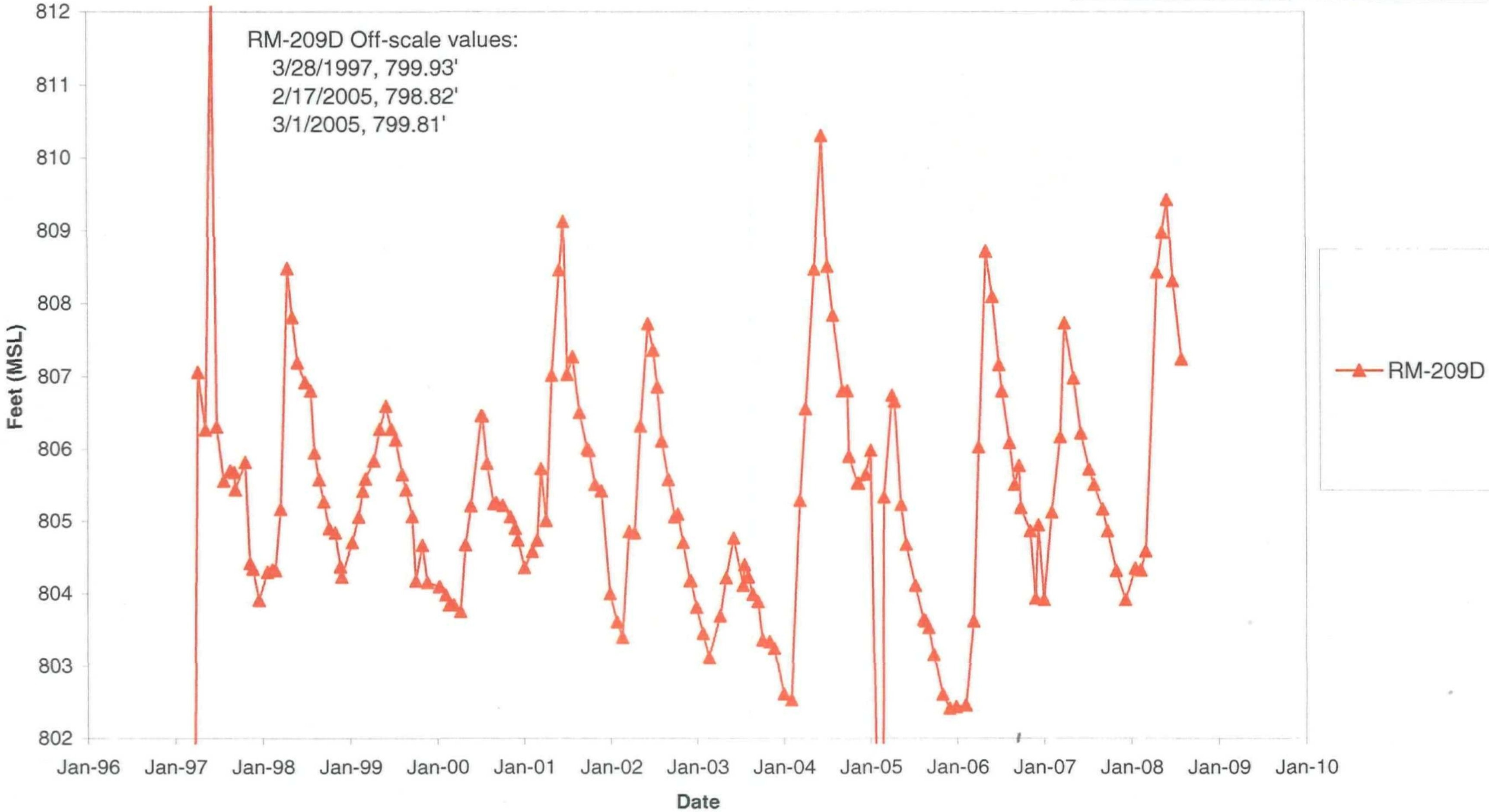
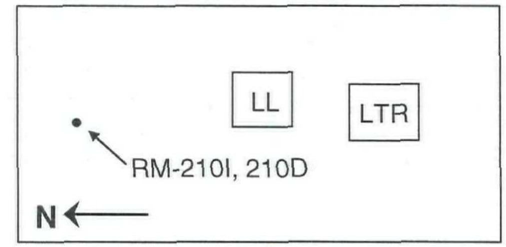
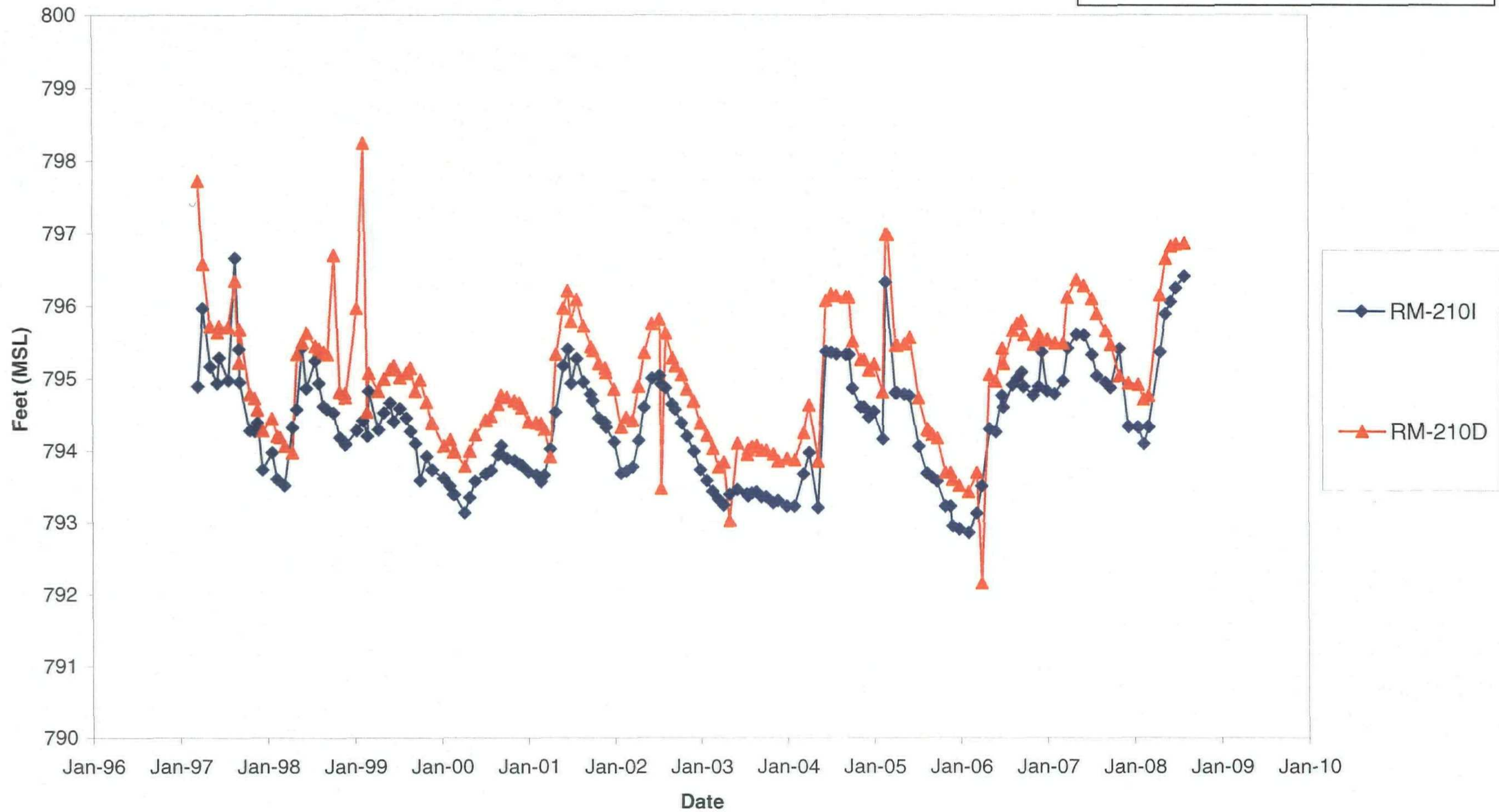
Groundwater Elevations Over Time
Lemberger Landfill





Groundwater Elevations Over Time
Lemberger Landfill





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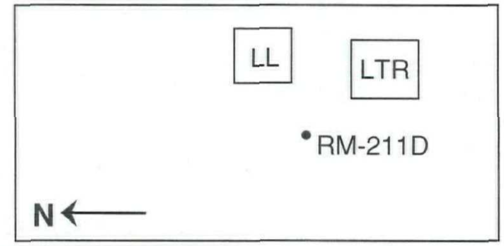
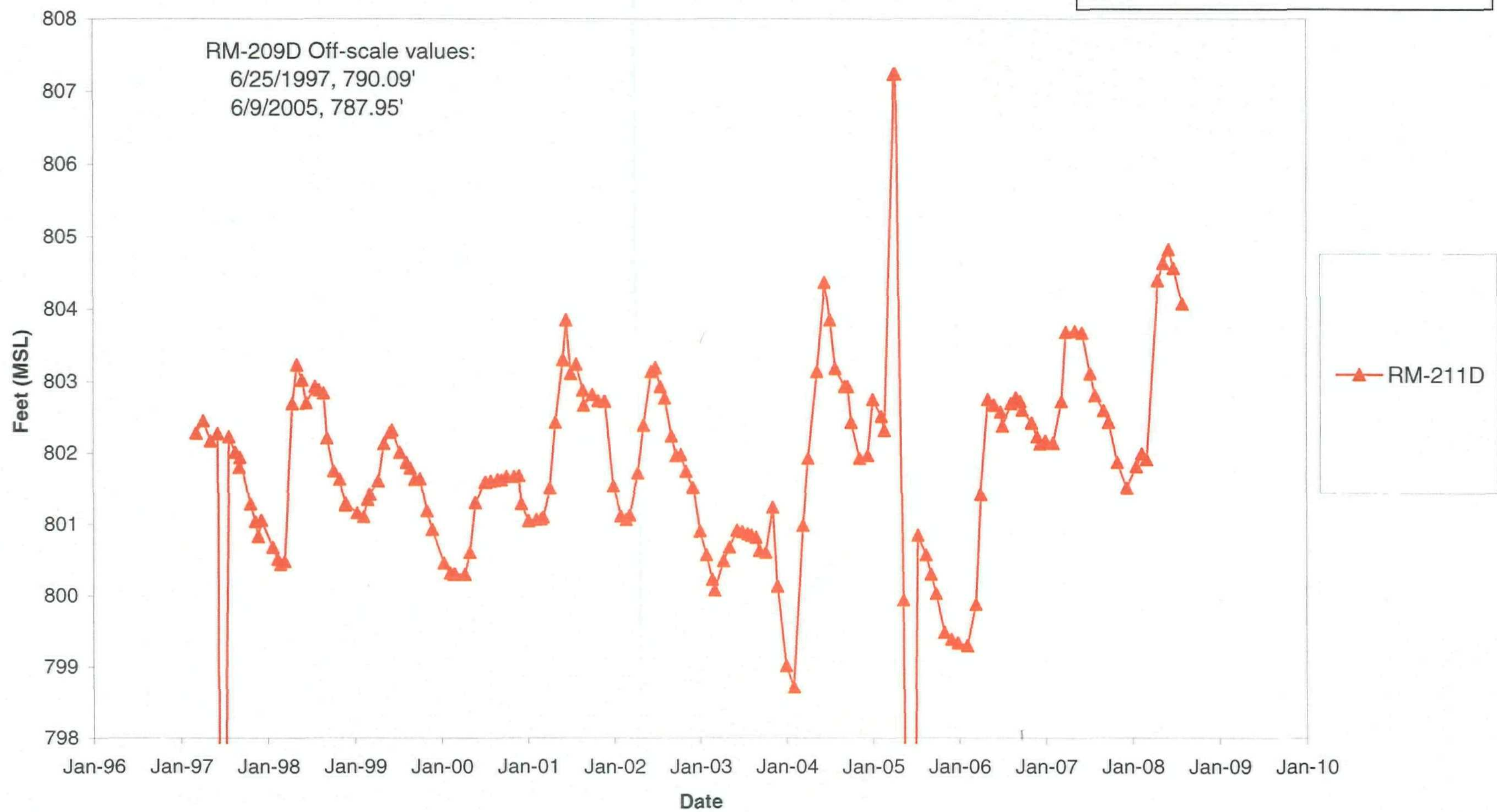
Groundwater Elevations Over Time
Lemberger Landfill





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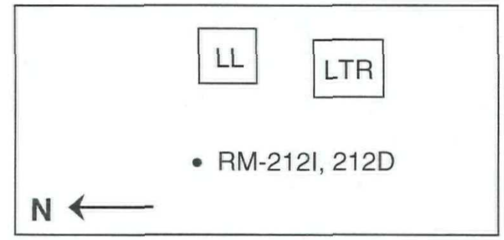
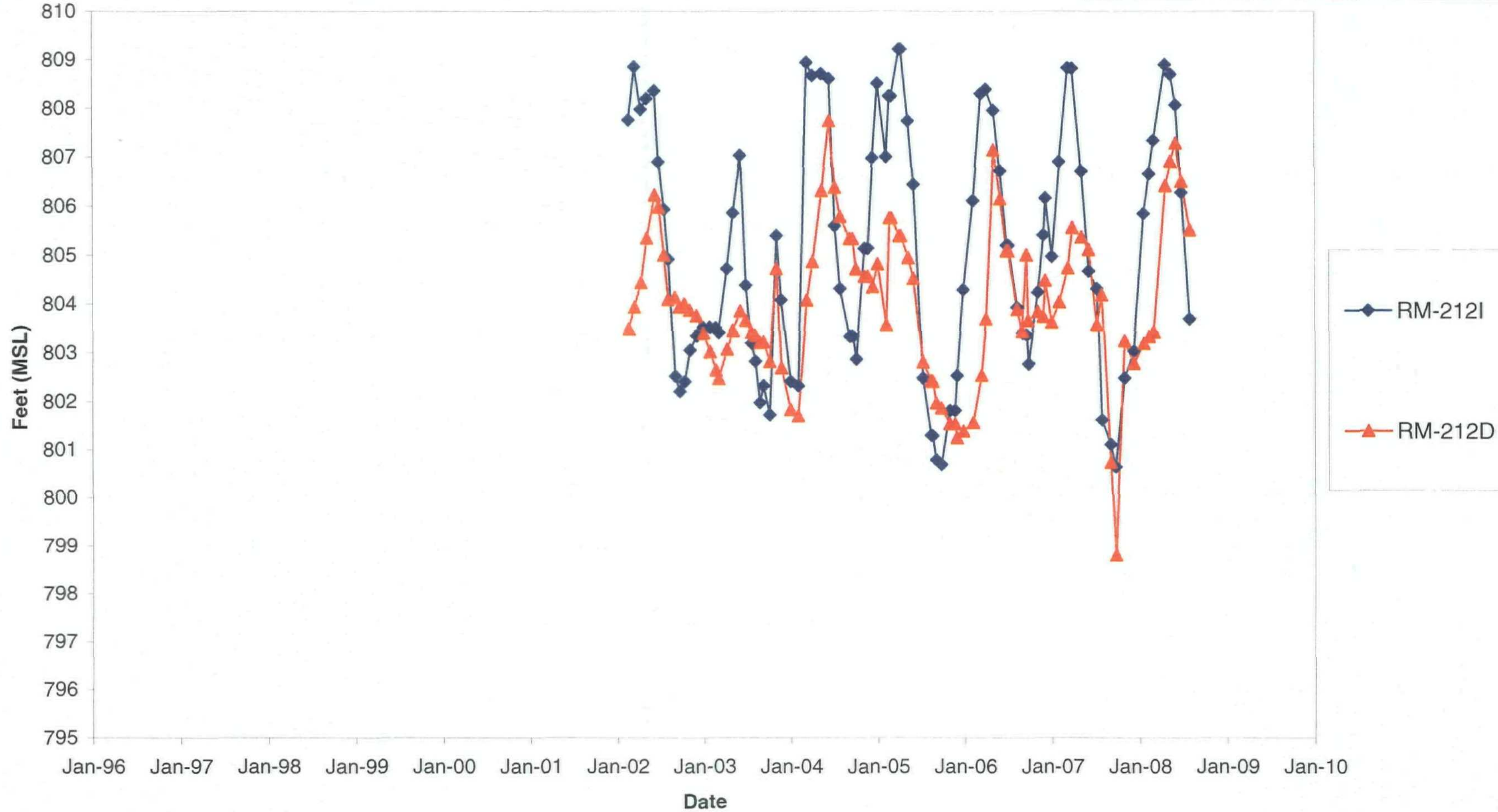
Groundwater Elevations Over Time
Lemberger Landfill





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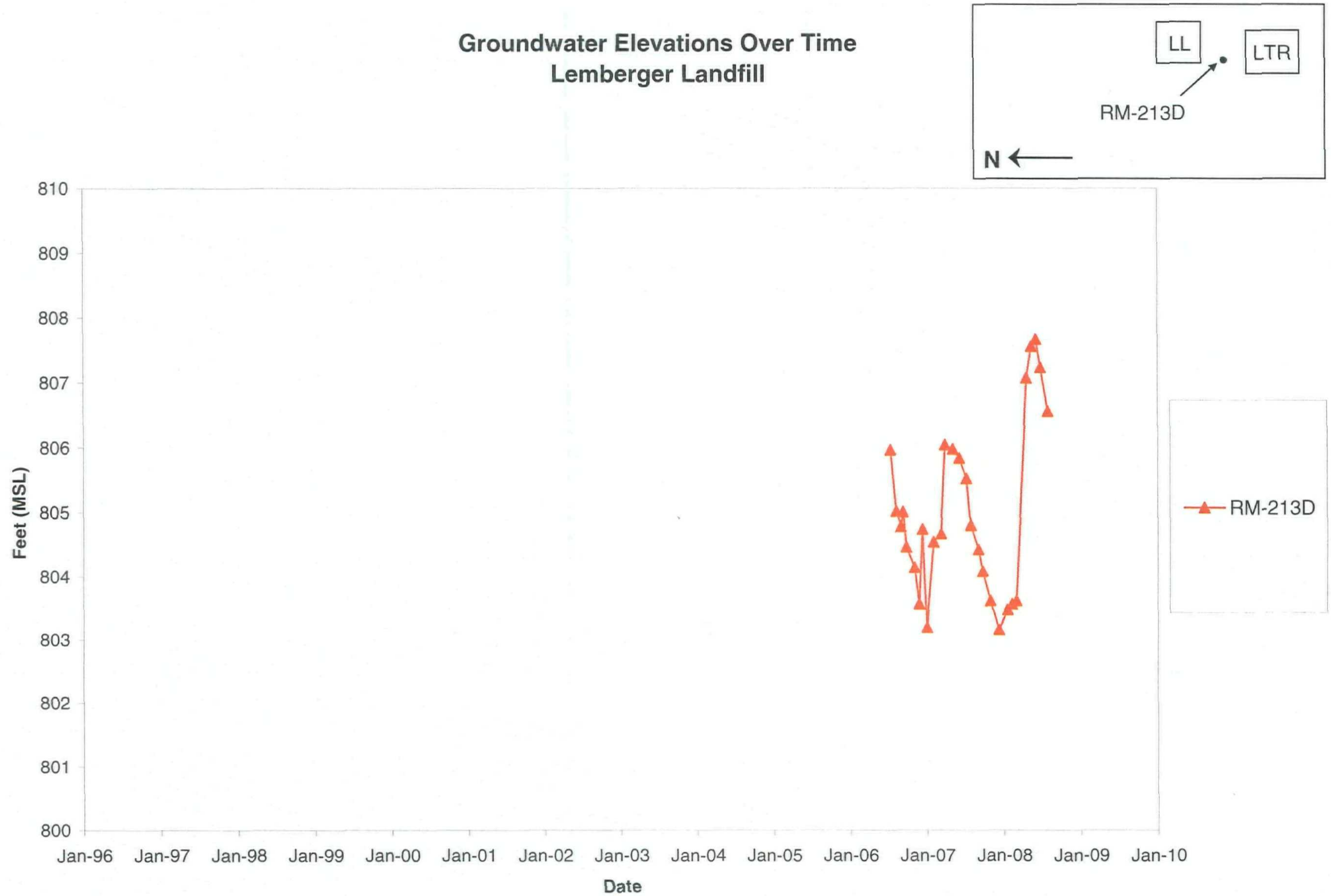

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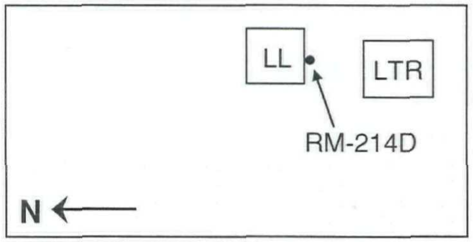
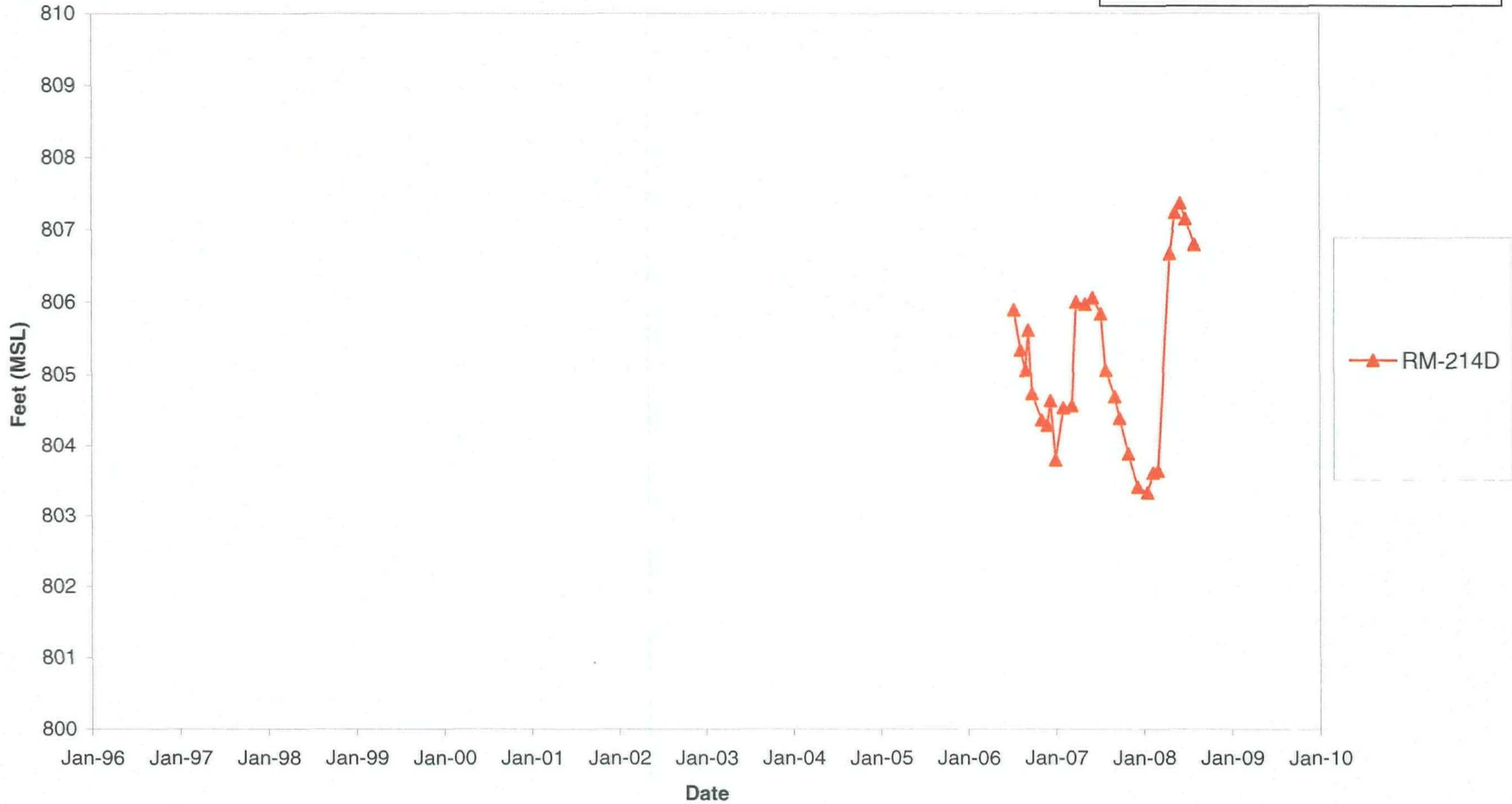
Groundwater Elevations Over Time
Lemberger Landfill





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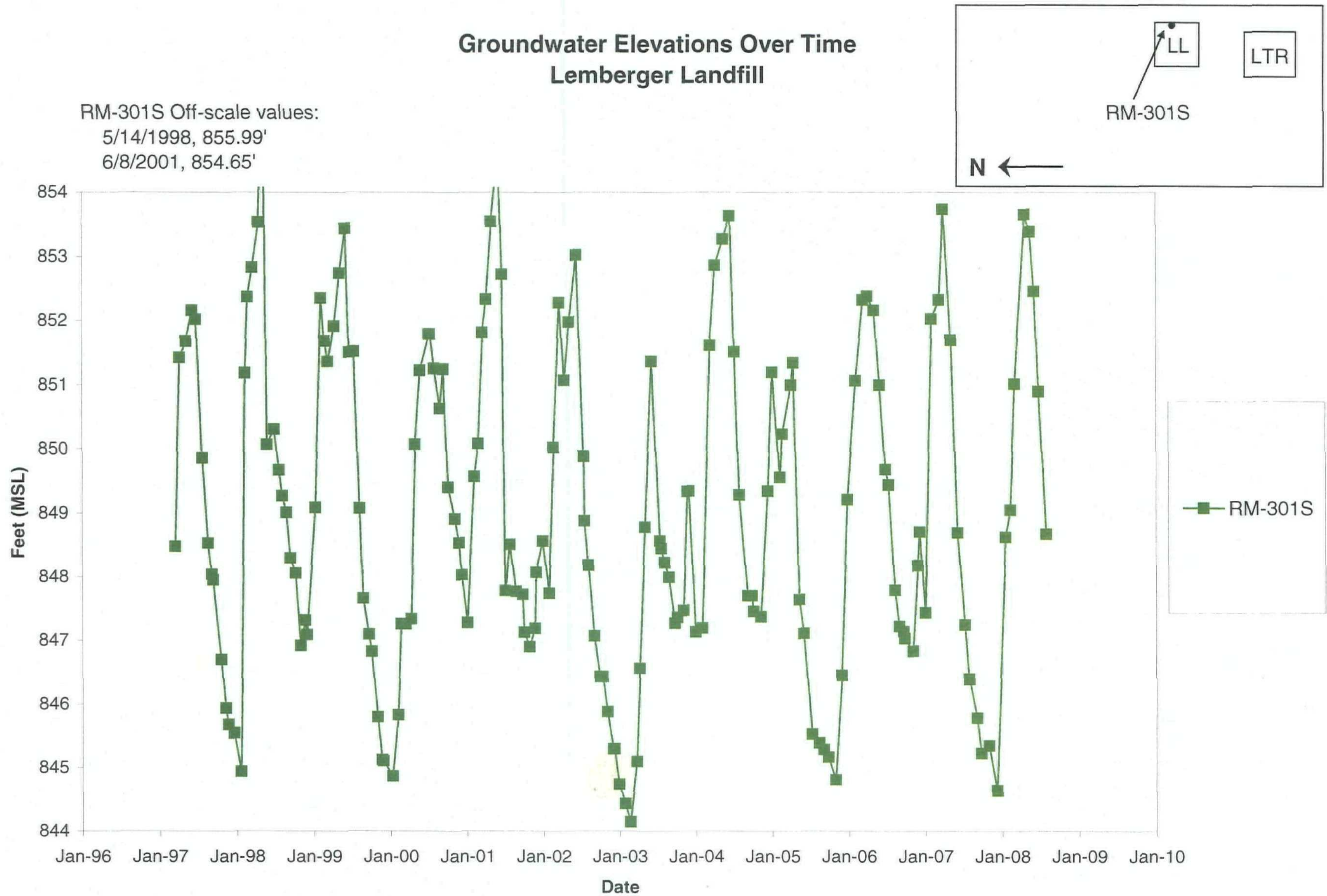

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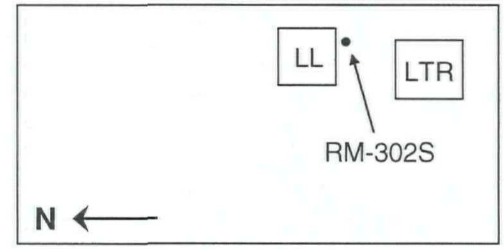
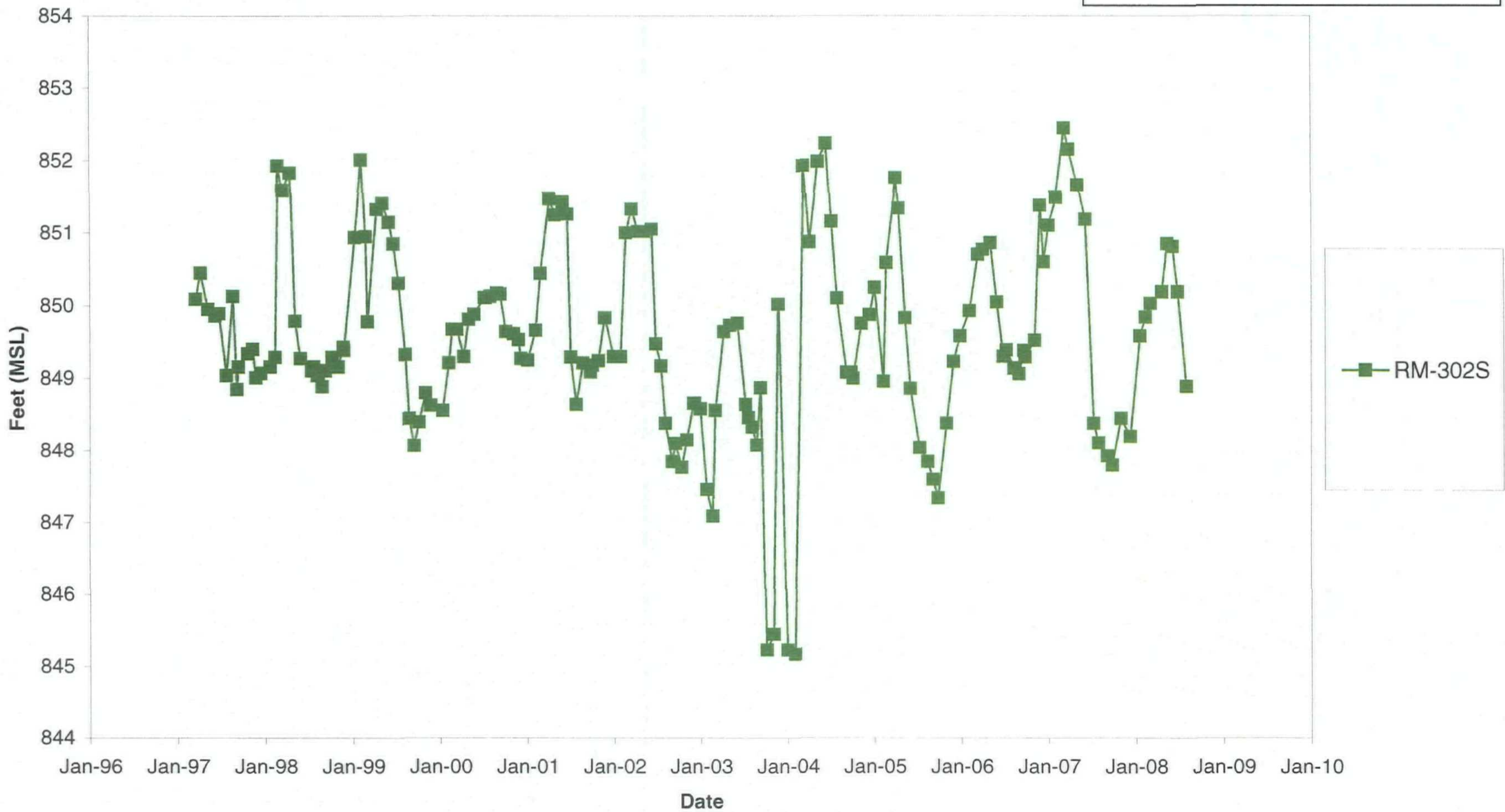
Groundwater Elevations Over Time
Lemberger Landfill





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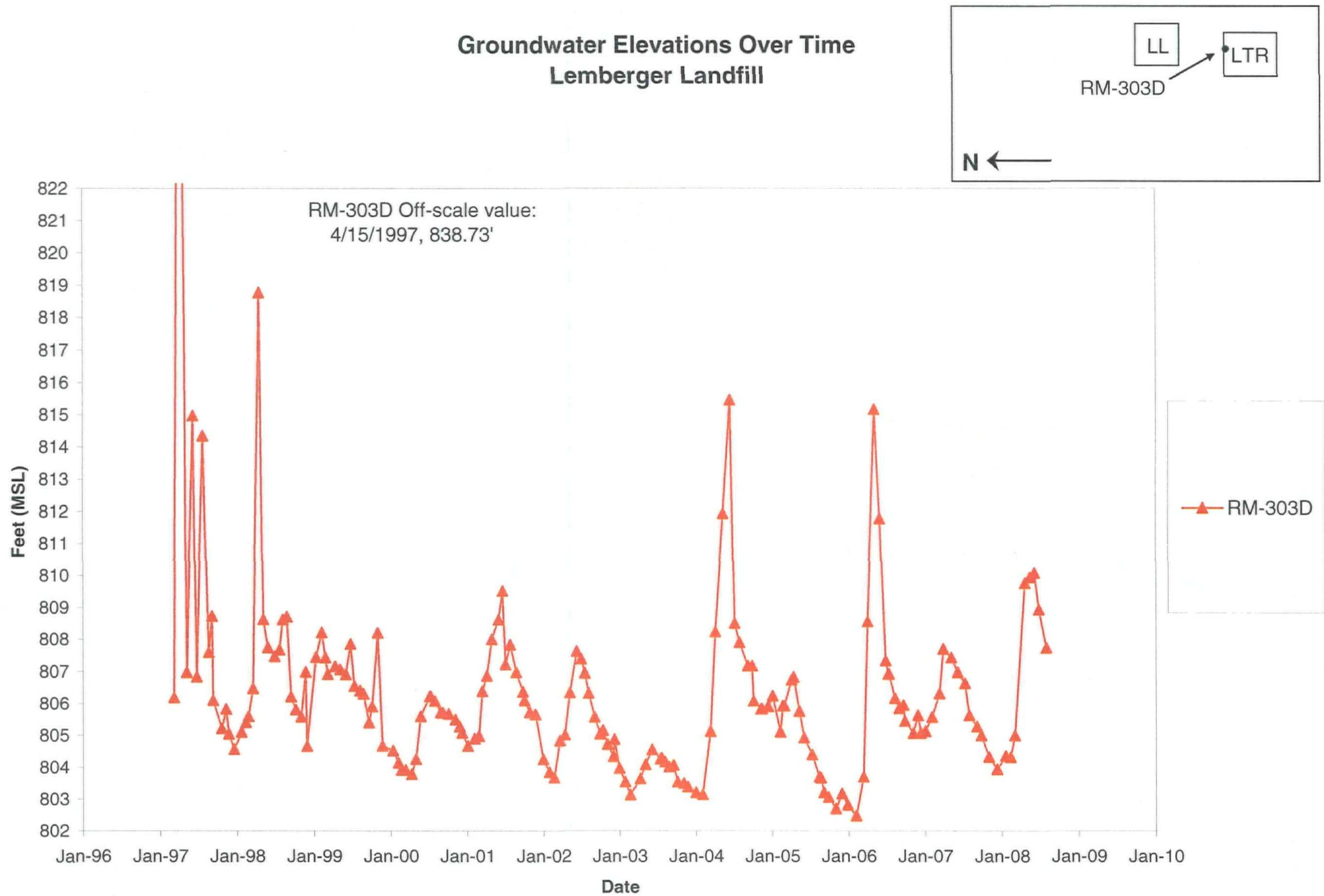

32

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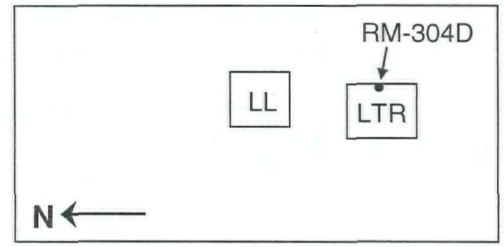
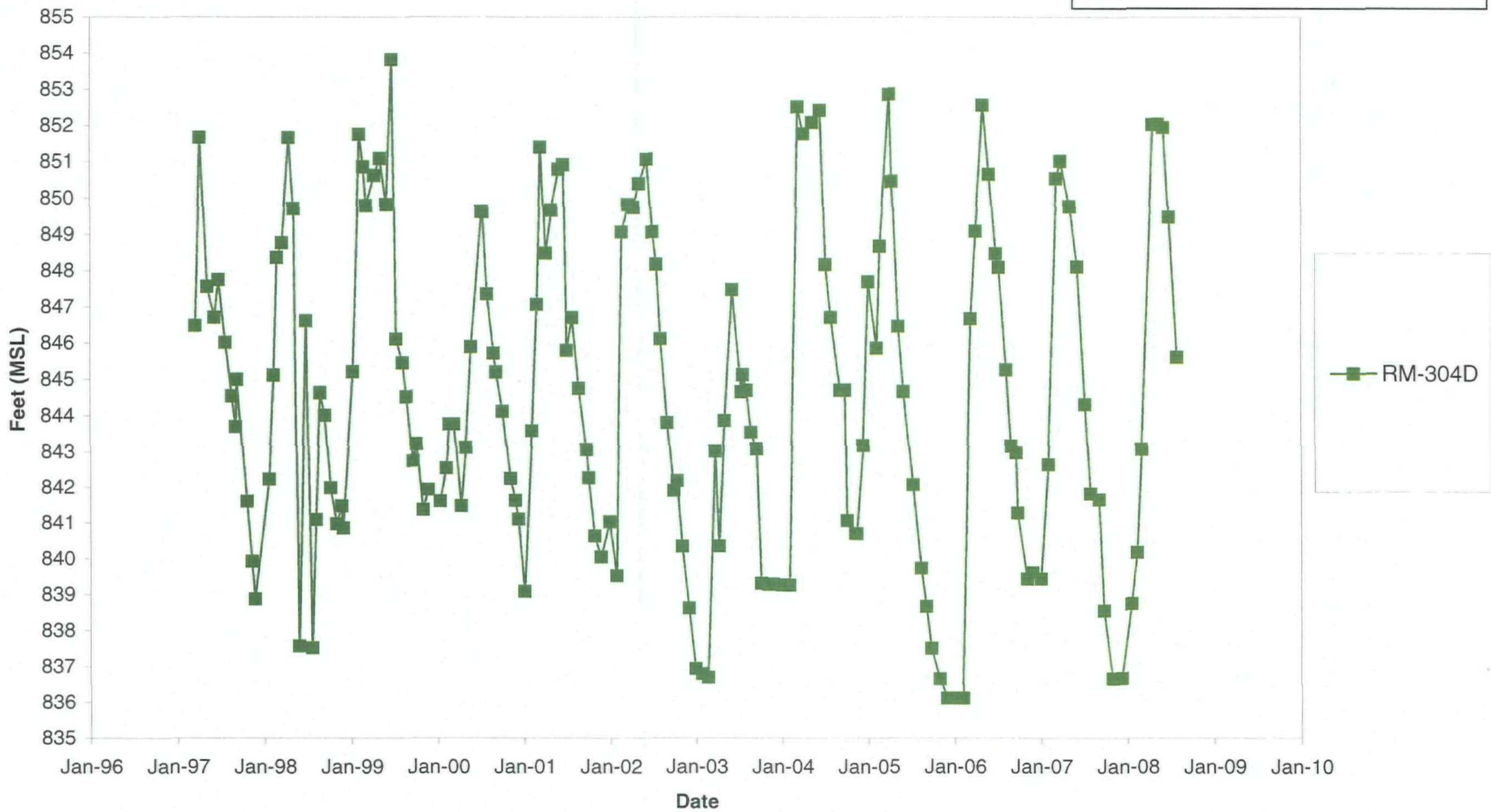
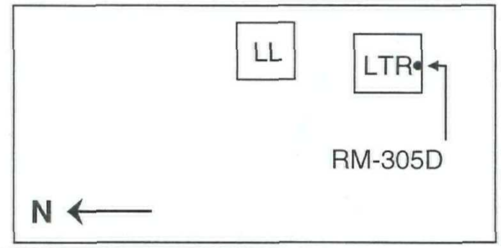
Groundwater Elevations Over Time
Lemberger Landfill

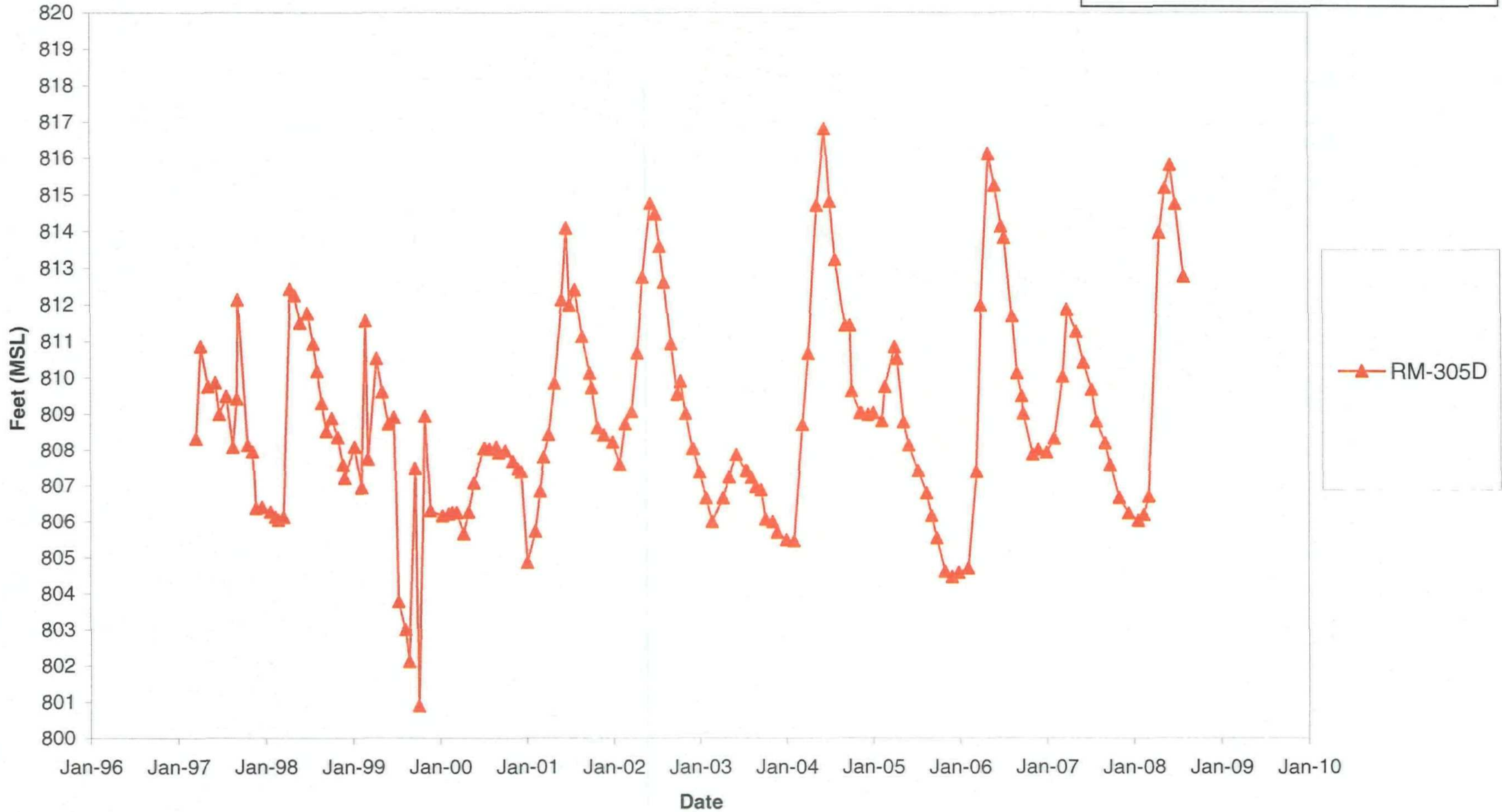




33

Groundwater Elevations Over Time
Lemberger Landfill





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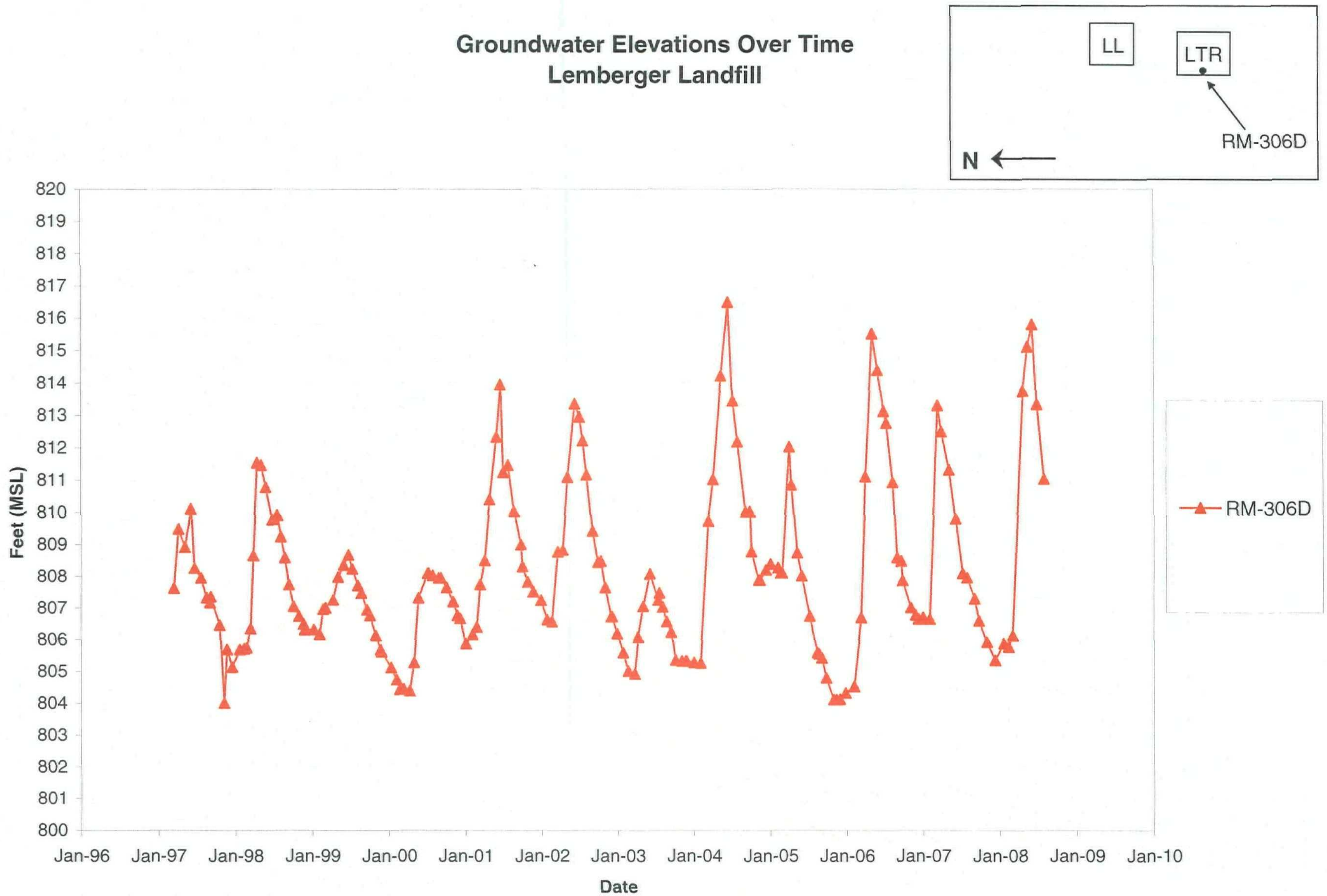

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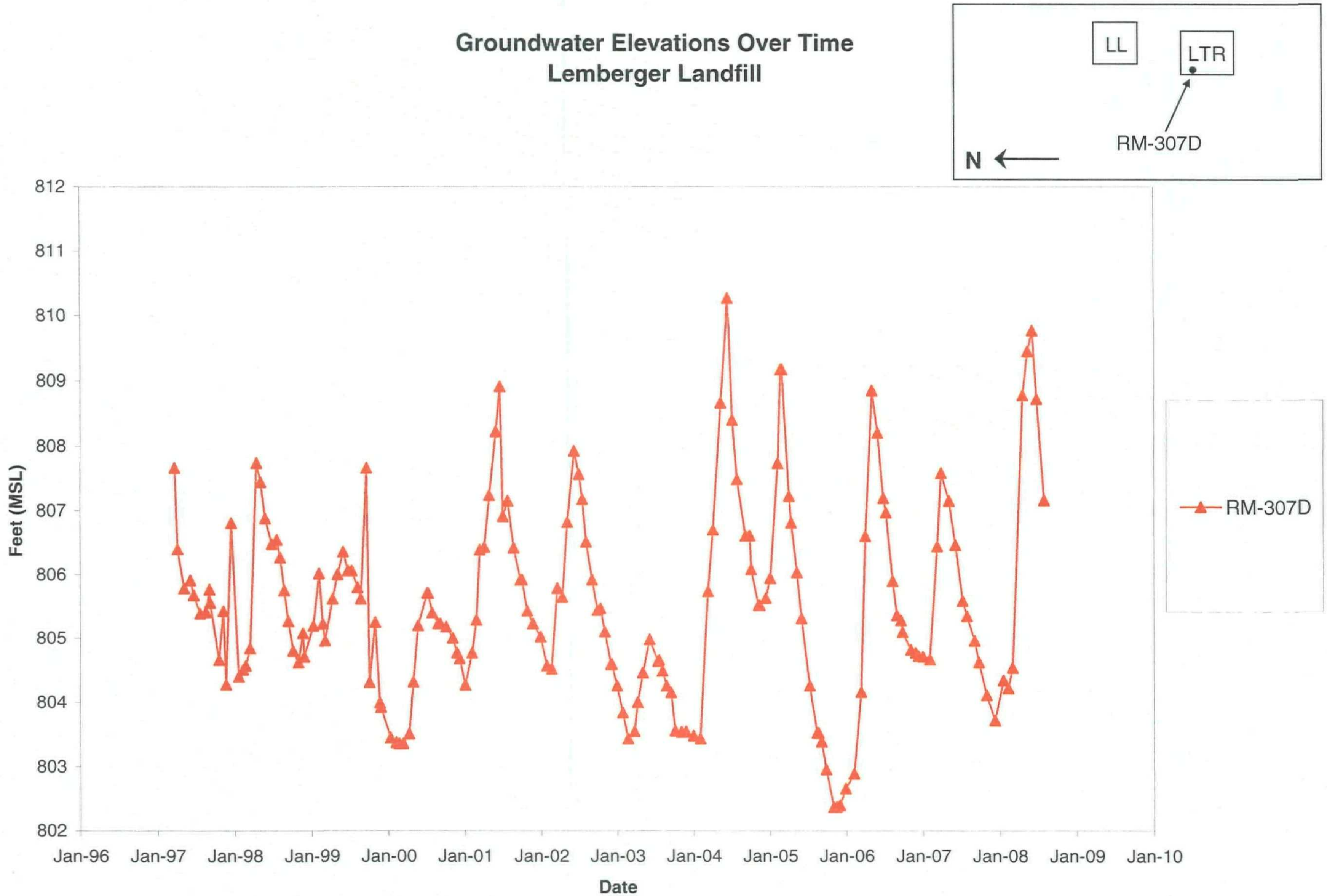

36

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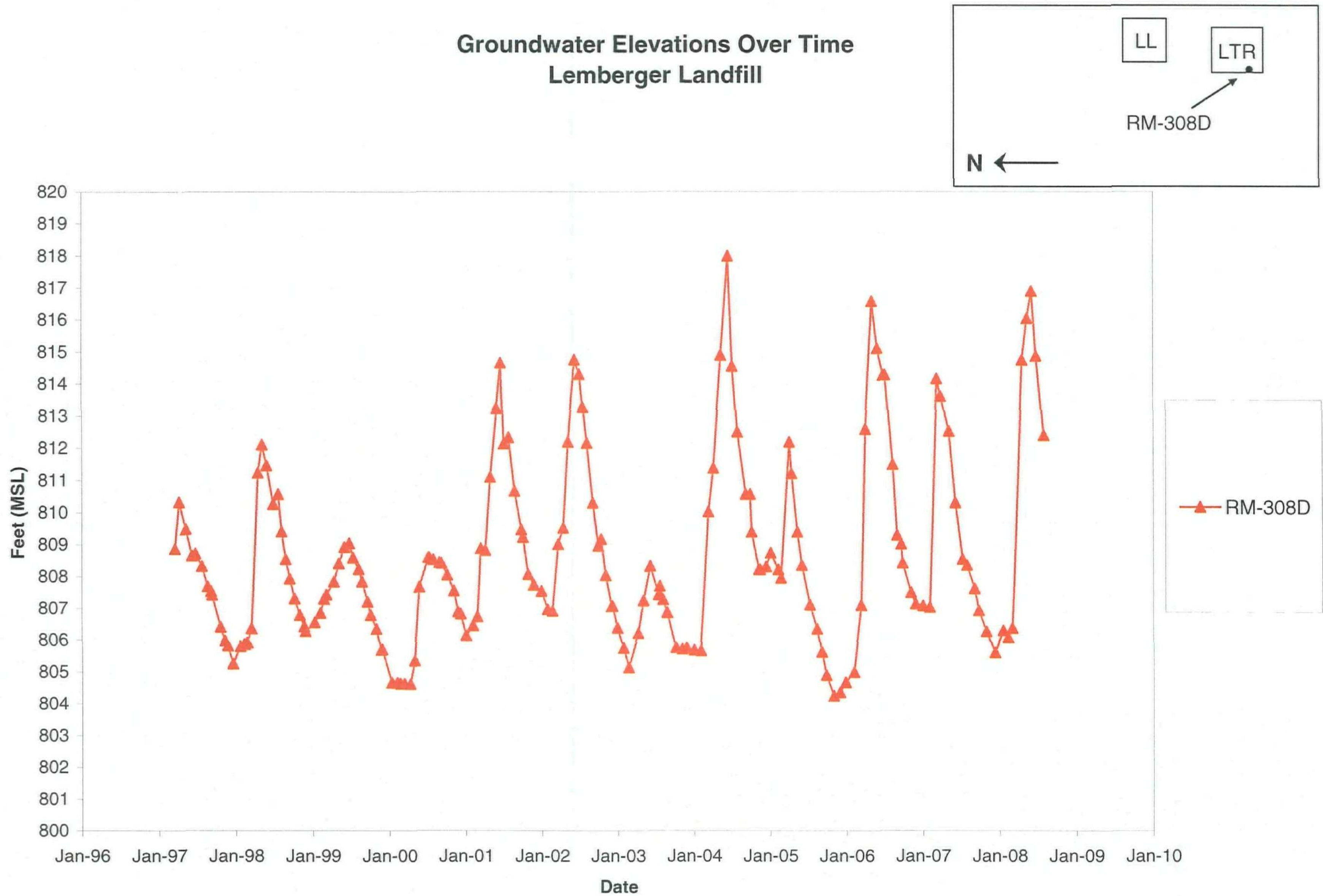
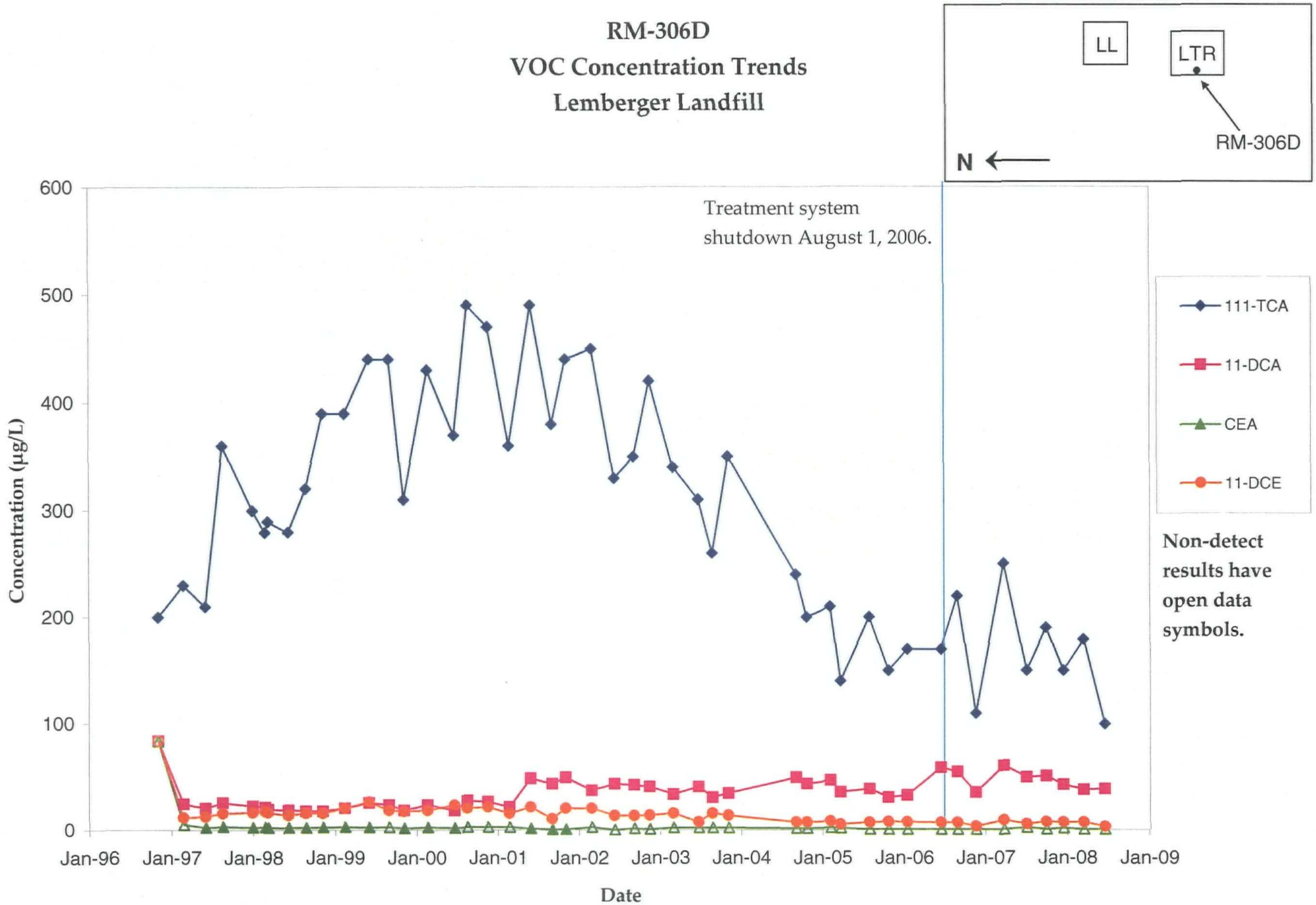

Groundwater Elevations Over Time
Lemberger Landfill
LL
LTR
RM-308D
N
Feet (MSL)
820
819
818
817
816
815
814
813
812
811
810
809
808
807
806
805
804
803
802
801
800
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Date
RM-308D

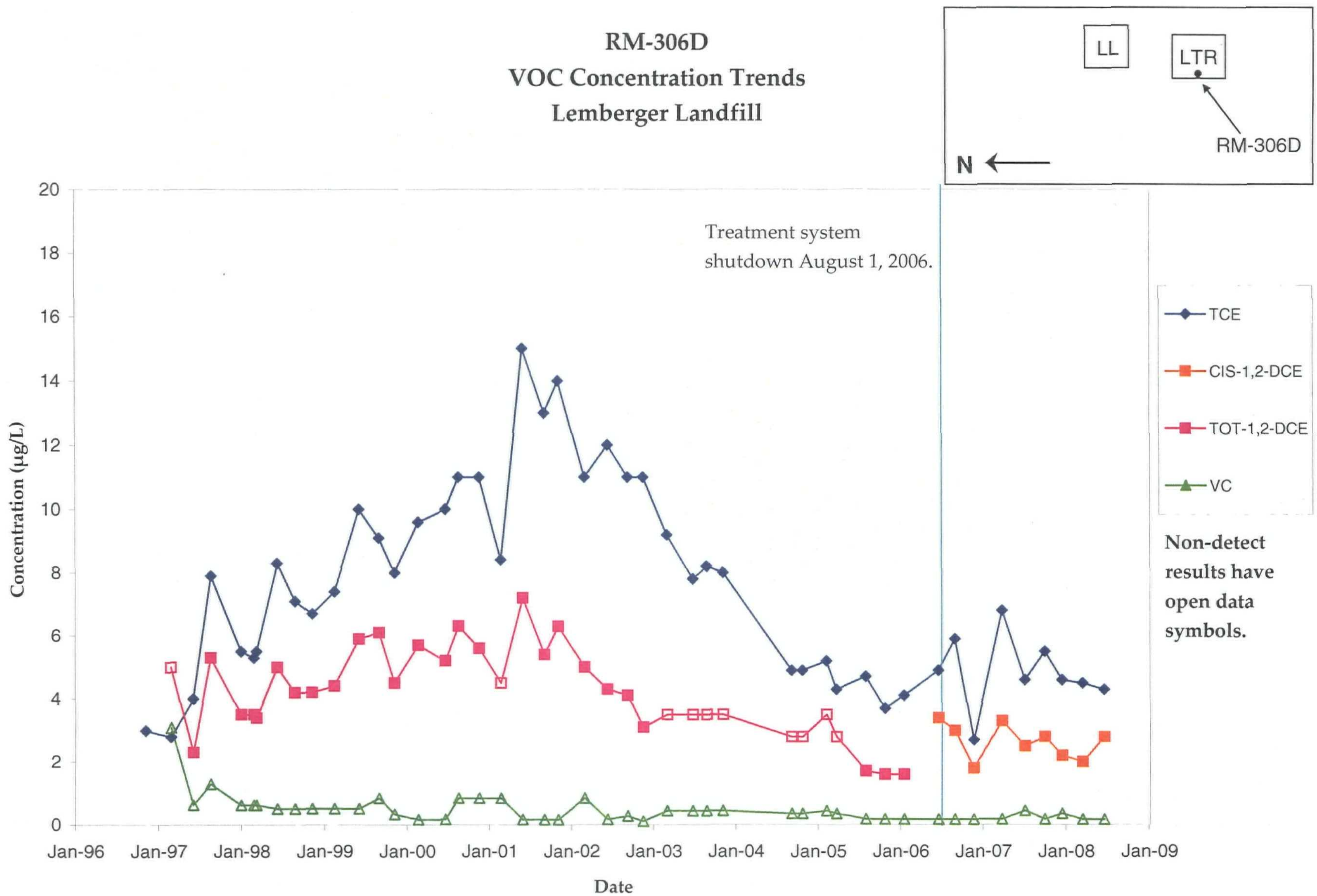
37/37

Appendix D
Laboratory Analytical Results

Appendix E
VOC Trend Plots


RM-306D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-306D
N
Treatment system shutdown August 1, 2006.
600
500
400
300
200
100
0
Concentration (µg/L)
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.

104



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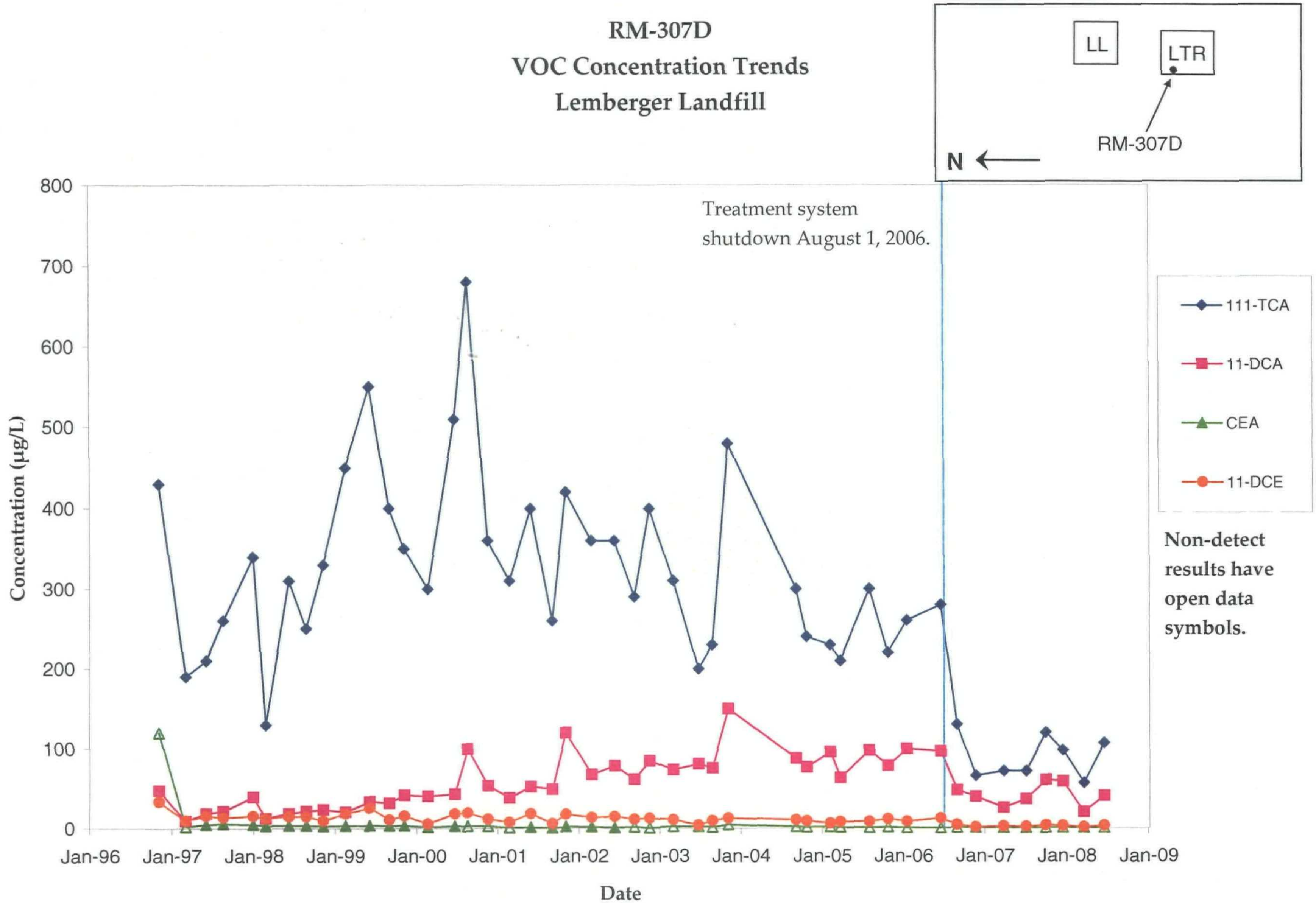
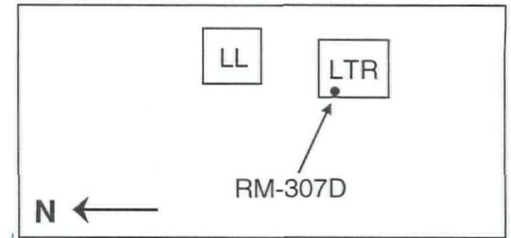
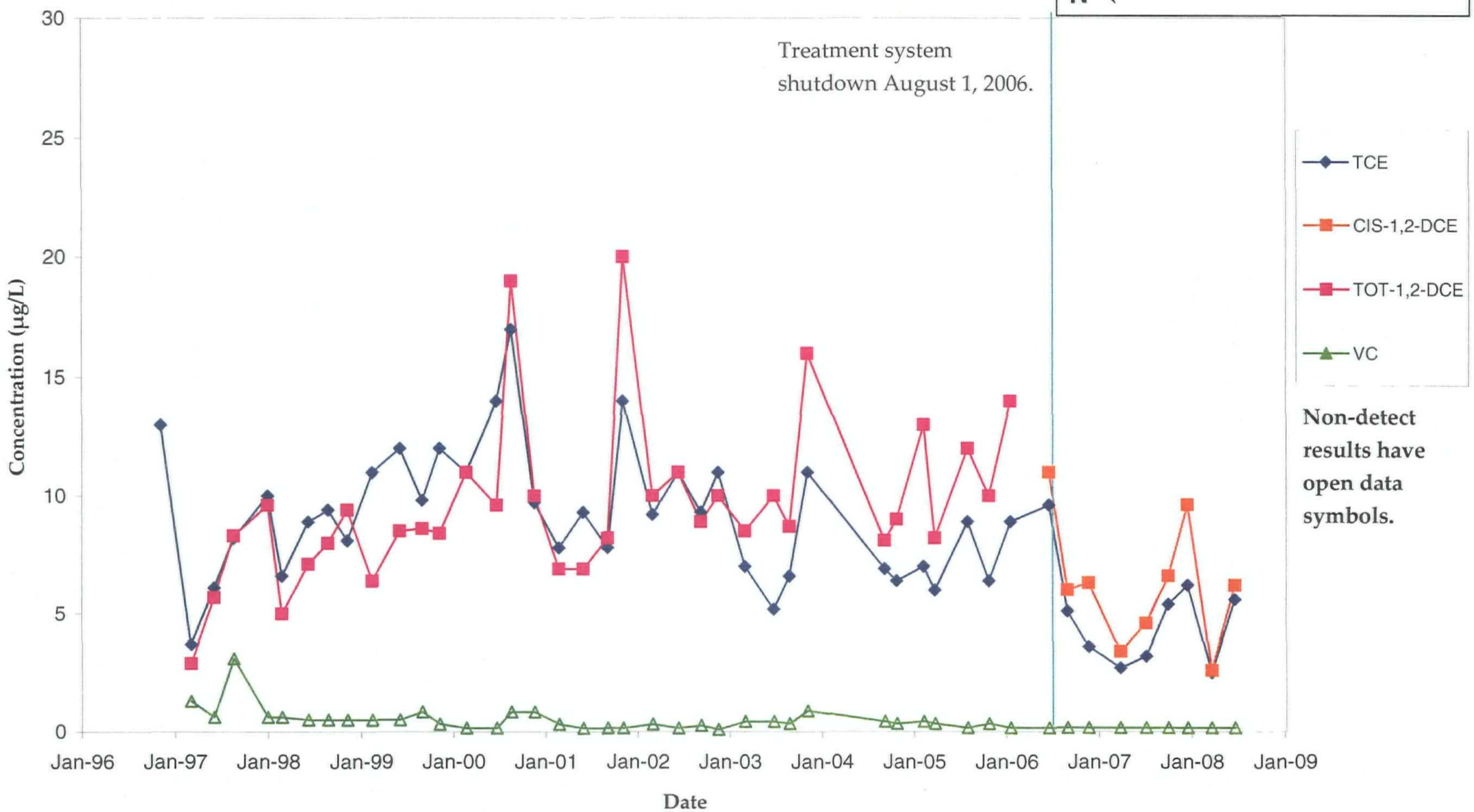
RM-307D
VOC Concentration Trends
Lemberger Landfill



3

RM-307D
VOC Concentration Trends
Lemberger Landfill





7

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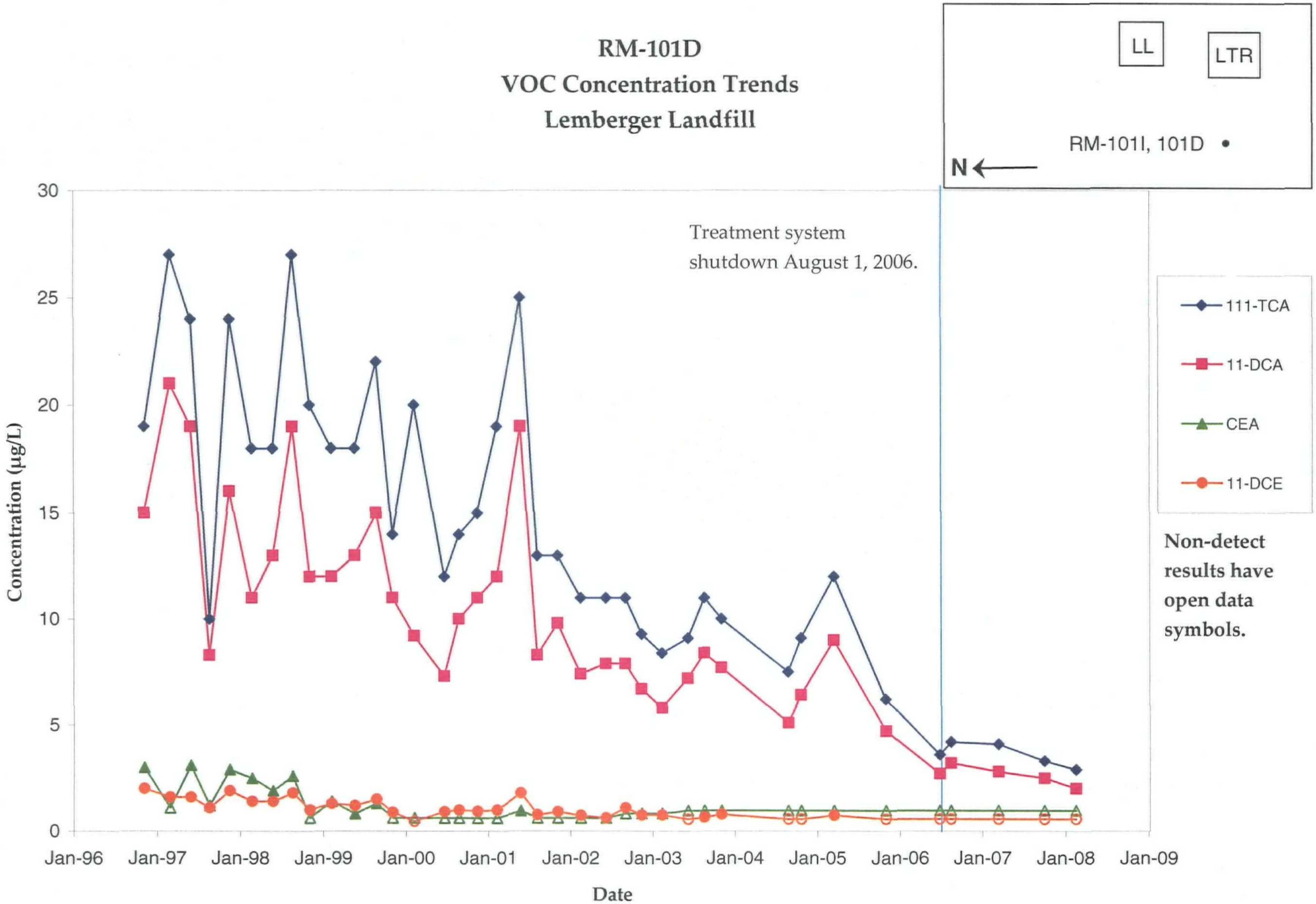
RM-101D
VOC Concentration Trends
Lemberger Landfill



5

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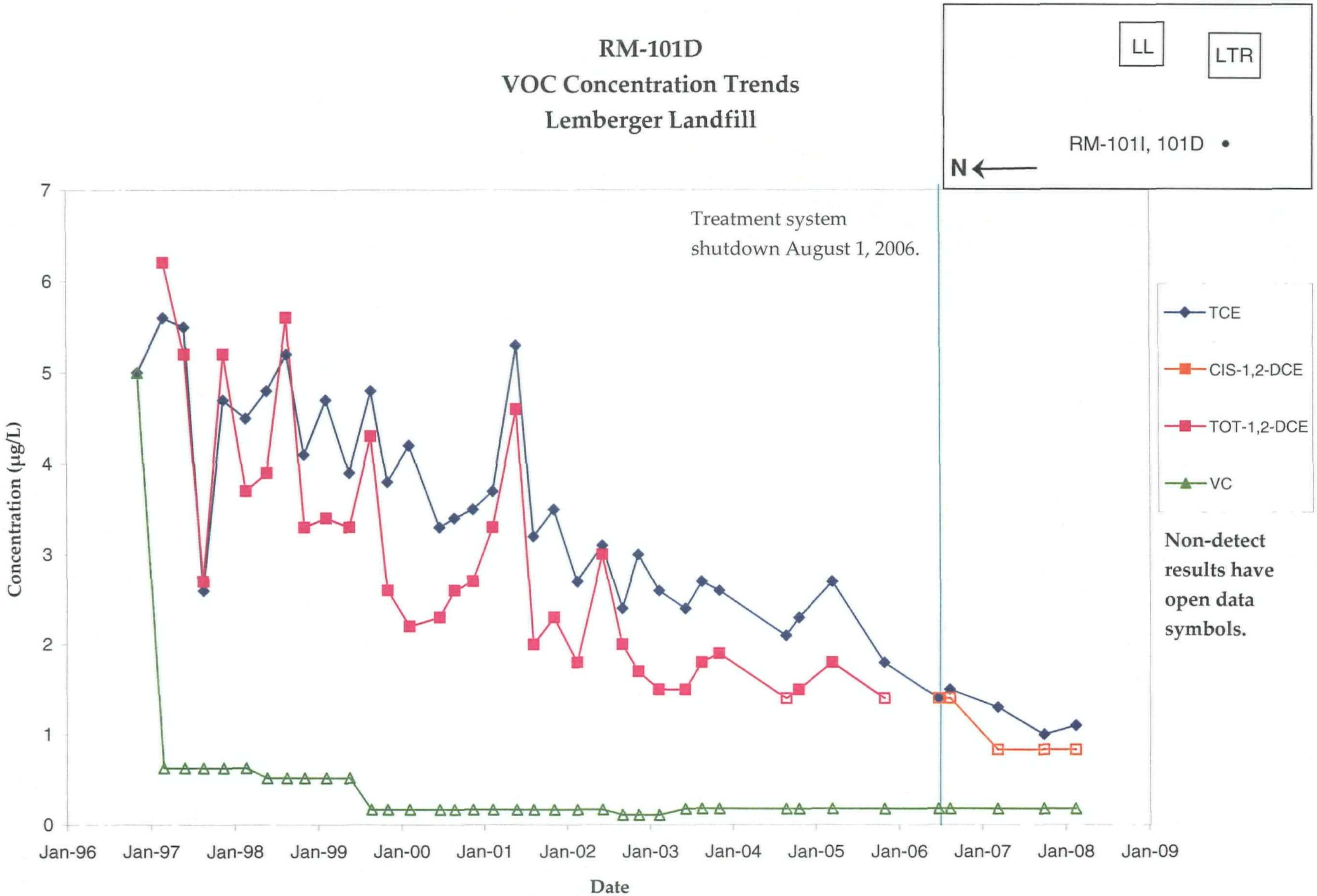
RM-101D
VOC Concentration Trends
Lemberger Landfill



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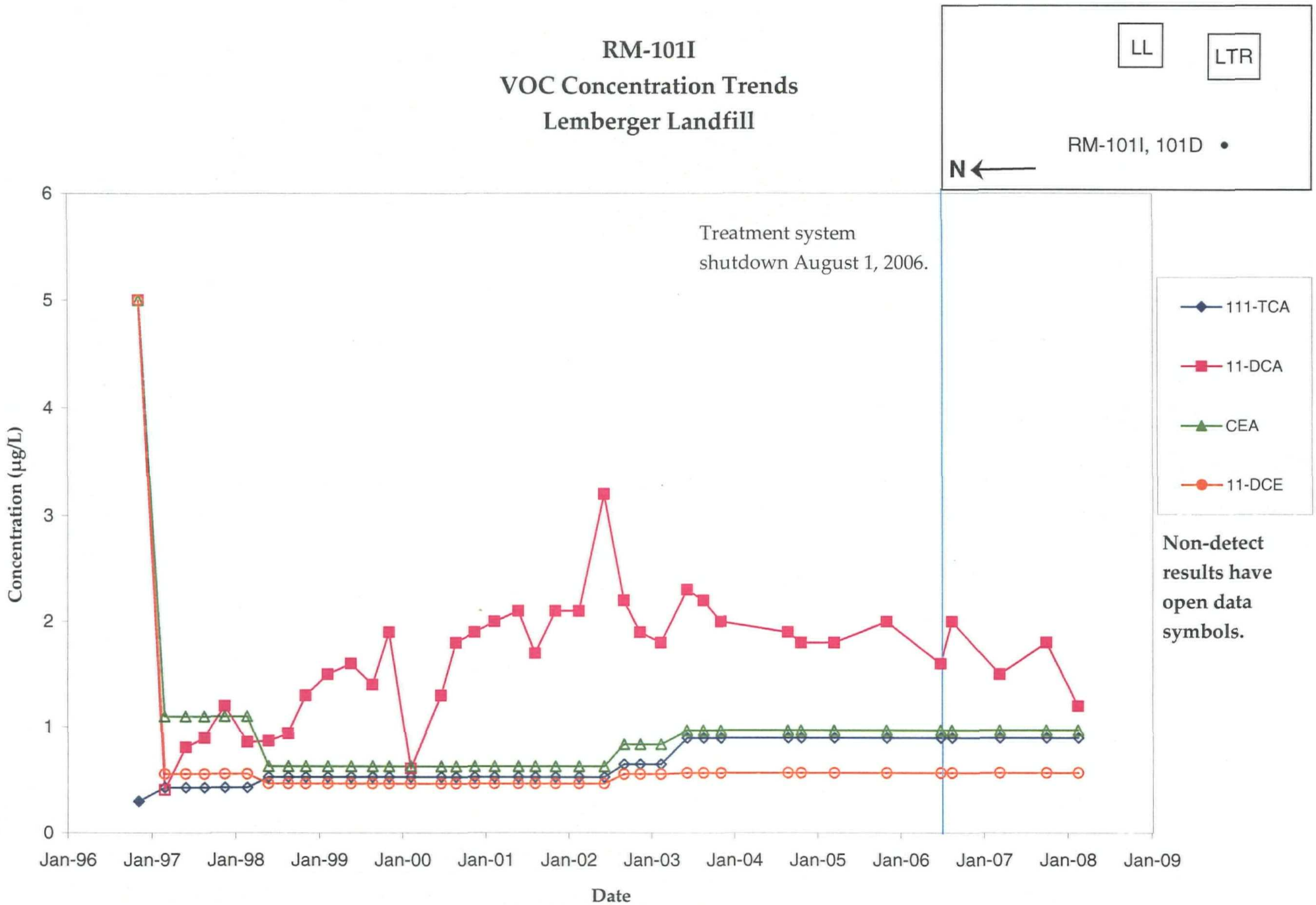
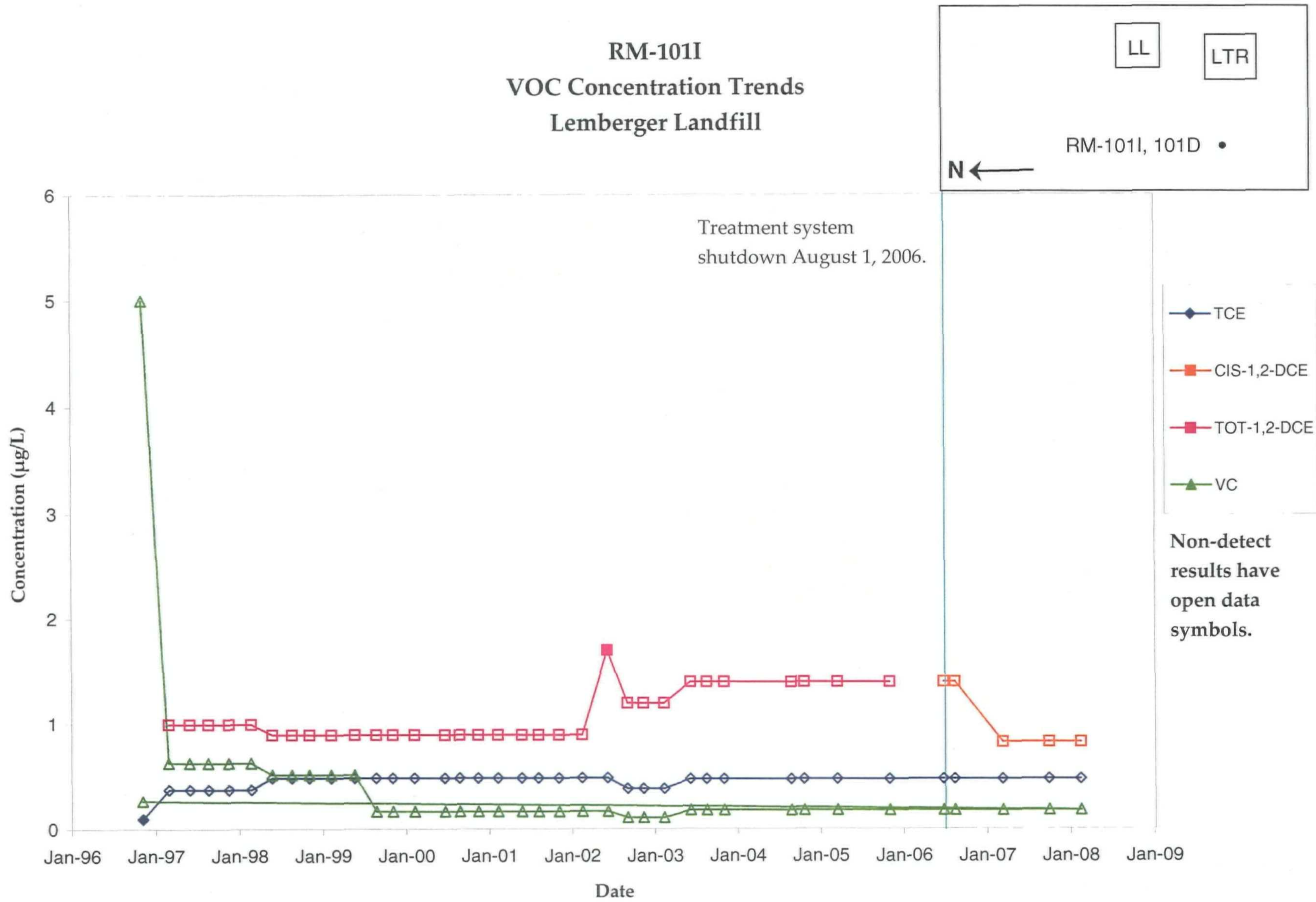


RM-101I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-101I, 101D
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date



8

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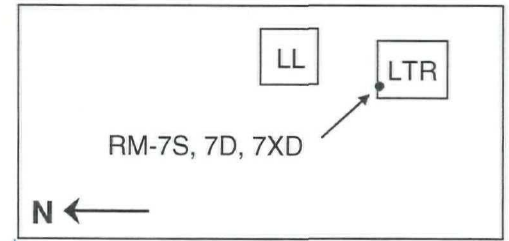
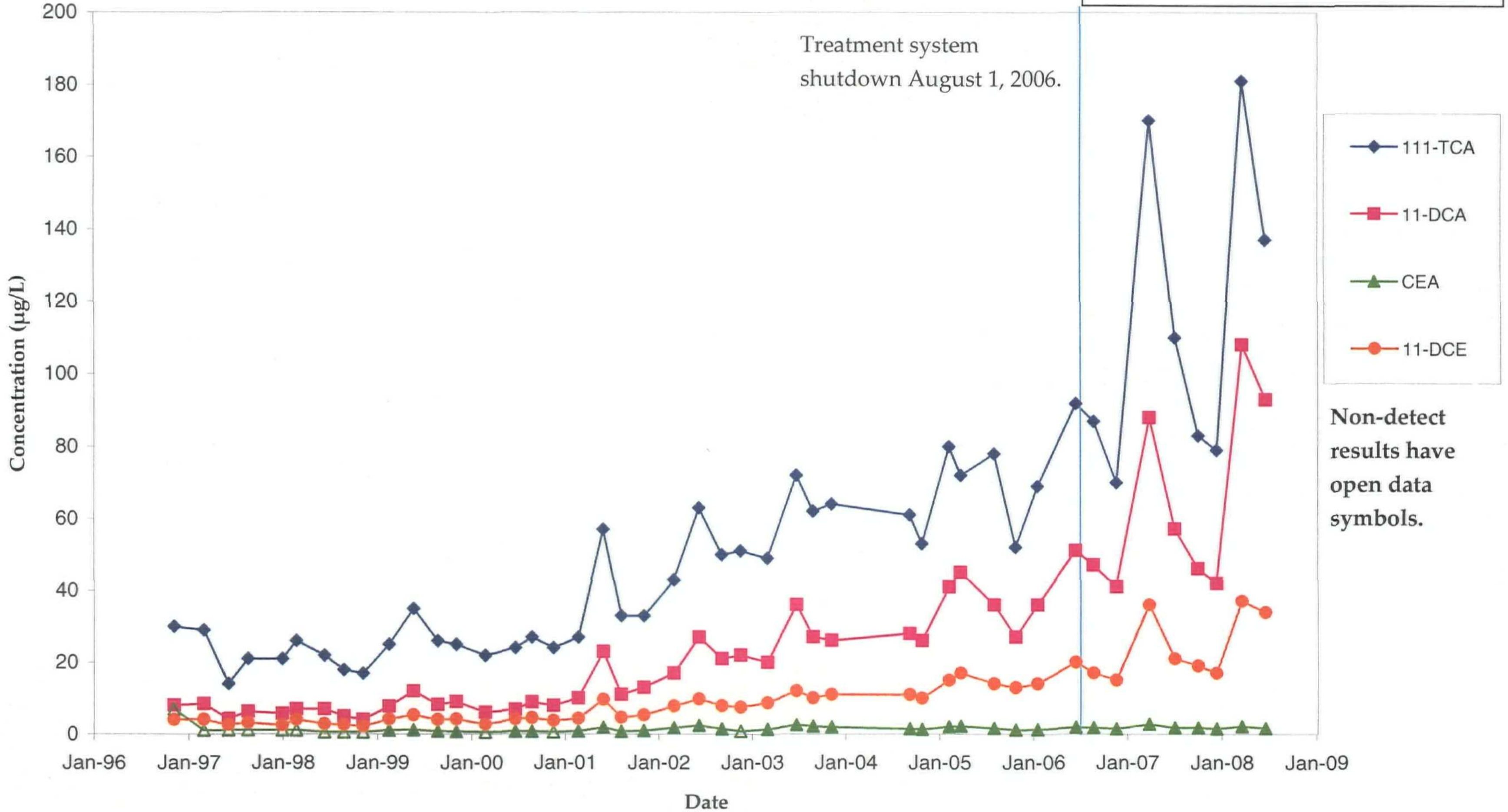
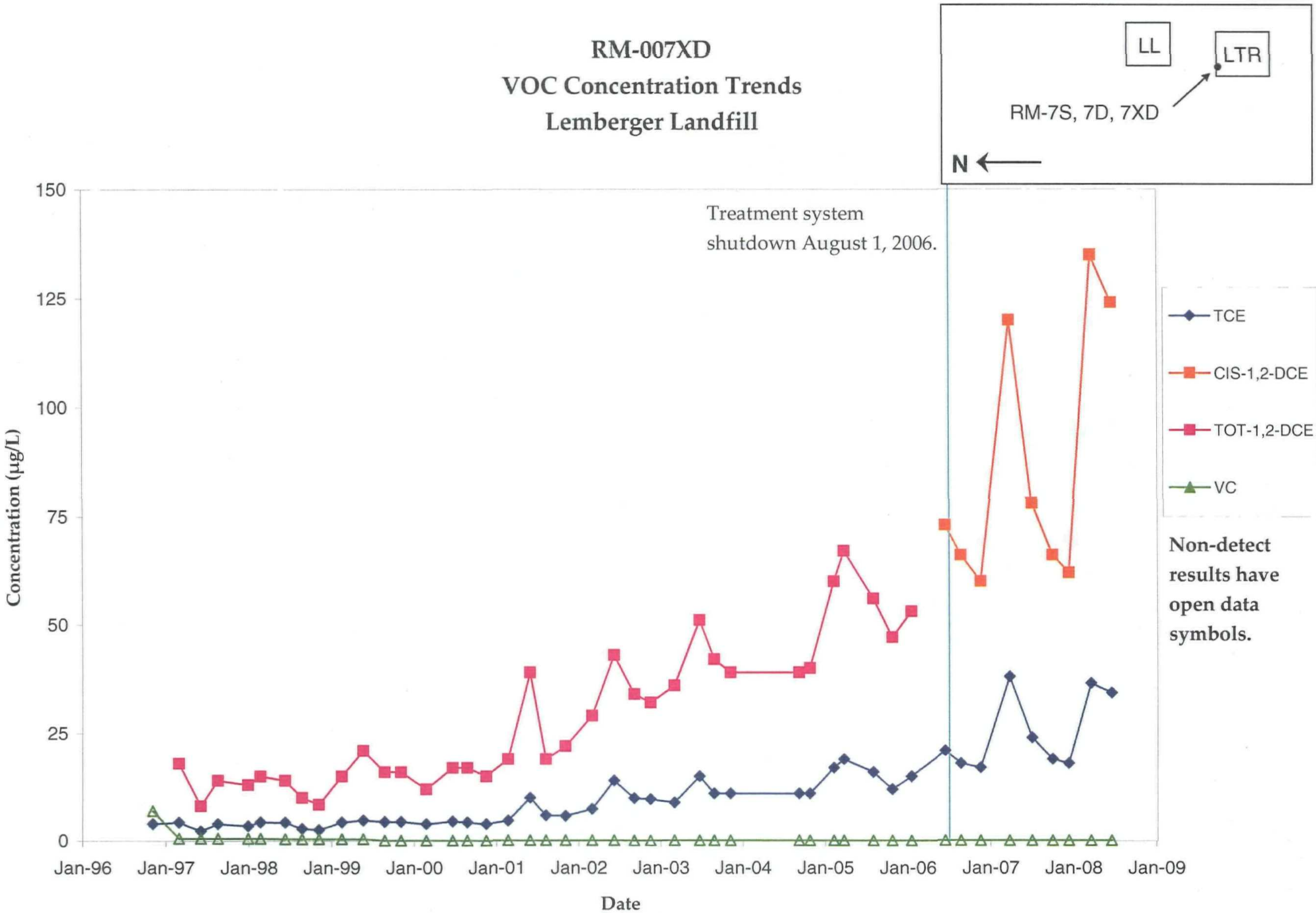
RM-007XD
VOC Concentration Trends
Lemberger Landfill

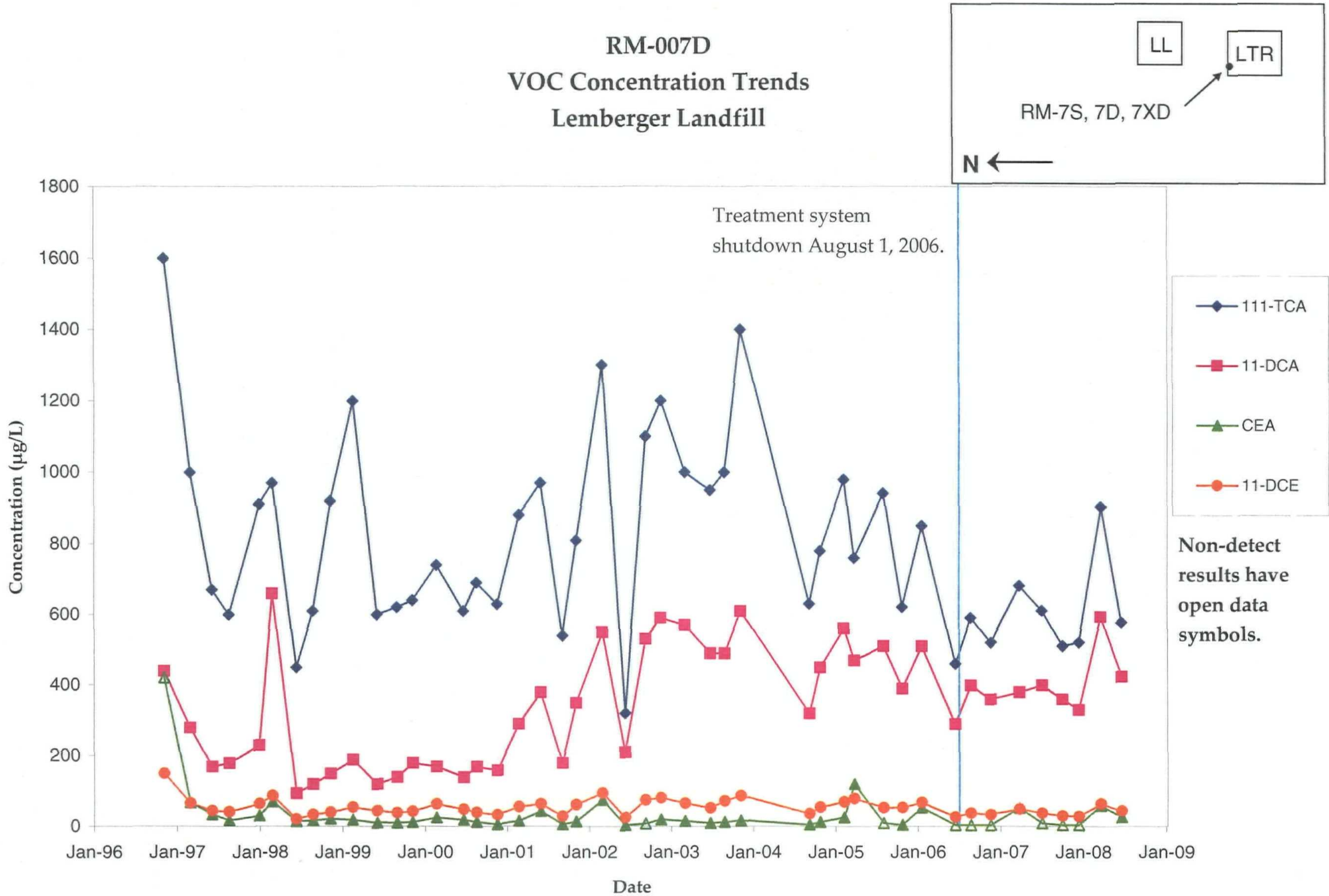


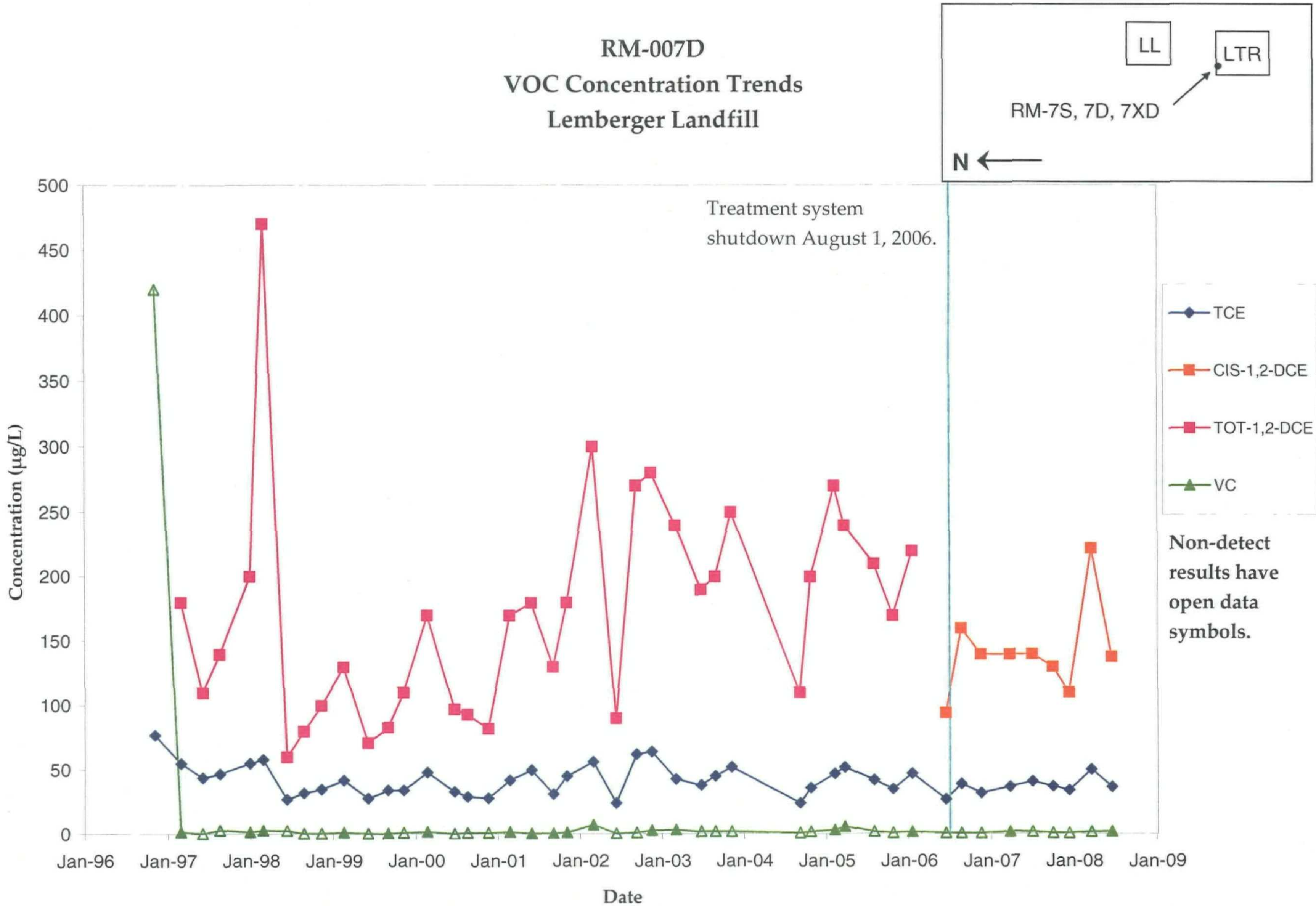


I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

RM-007XD
VOC Concentration Trends
Lemberger Landfill




RM-007D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-7S, 7D, 7XD
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
0
200
400
600
800
1000
1200
1400
1600
1800
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date



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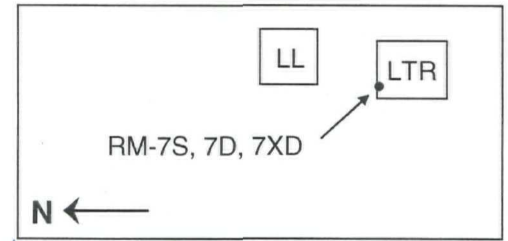
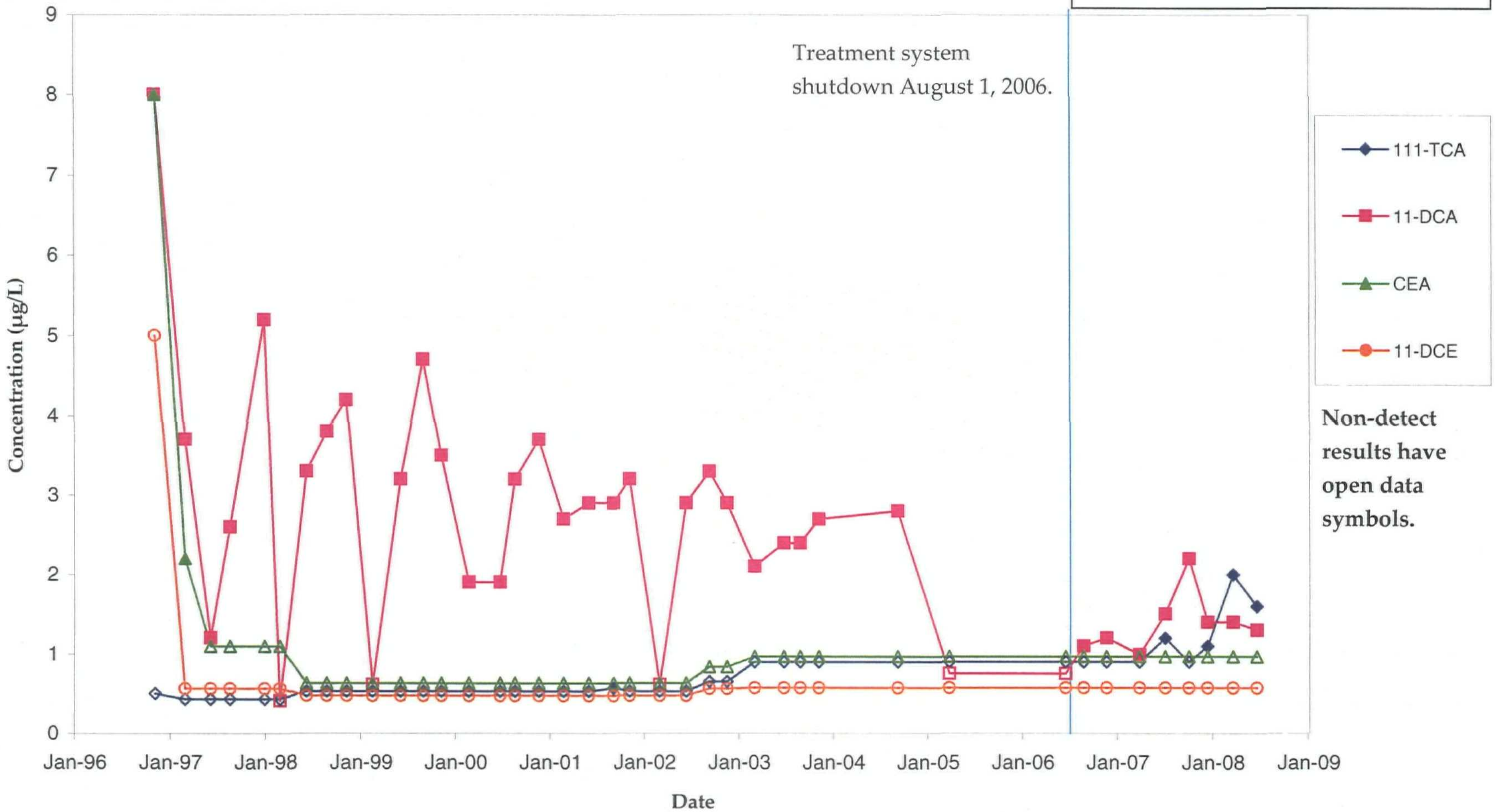
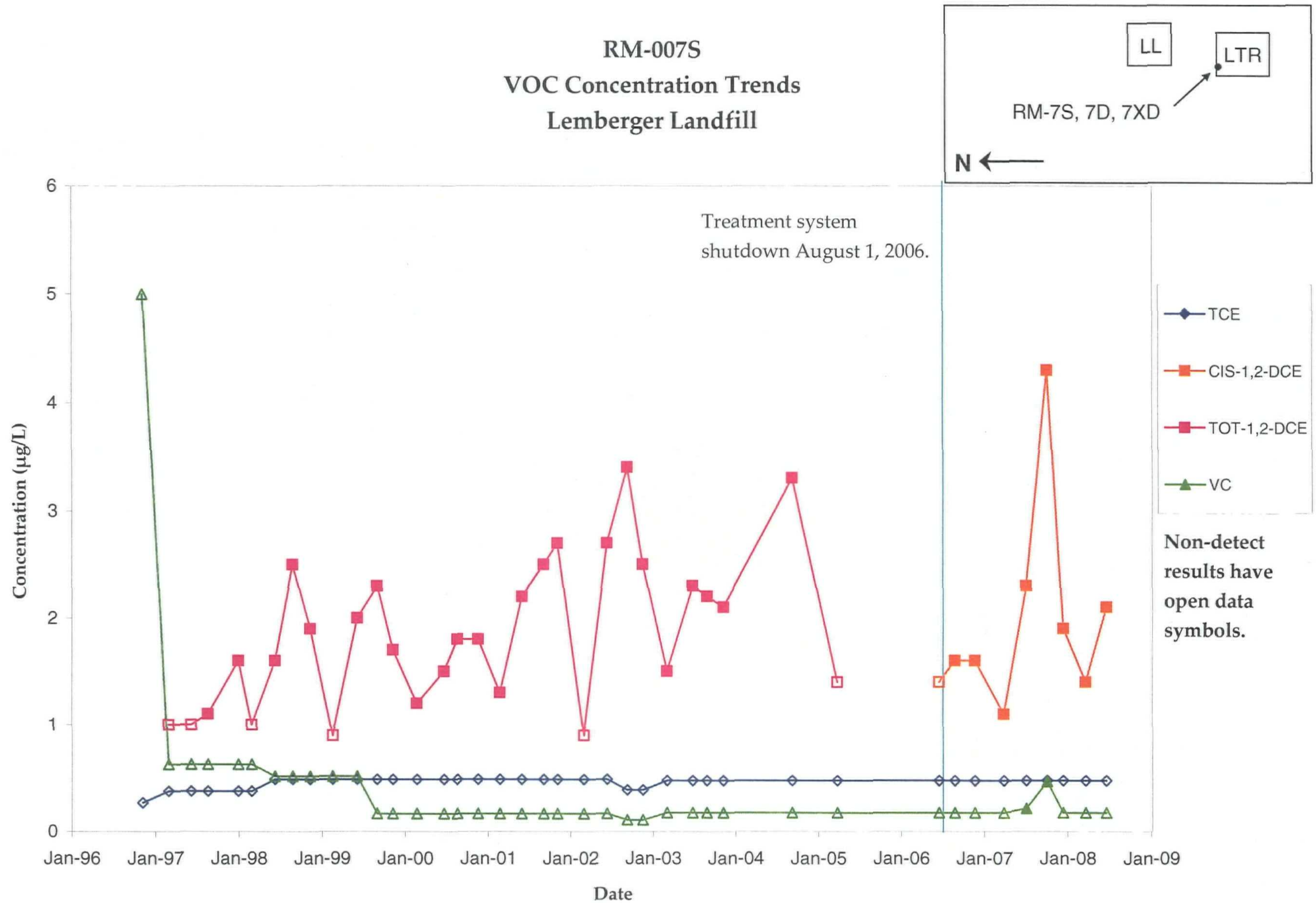
RM-007S
VOC Concentration Trends
Lemberger Landfill





13



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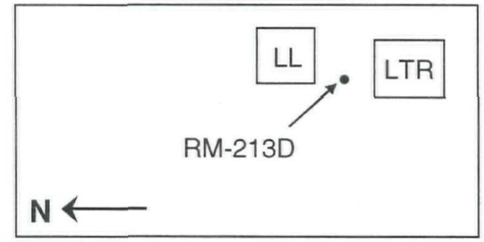
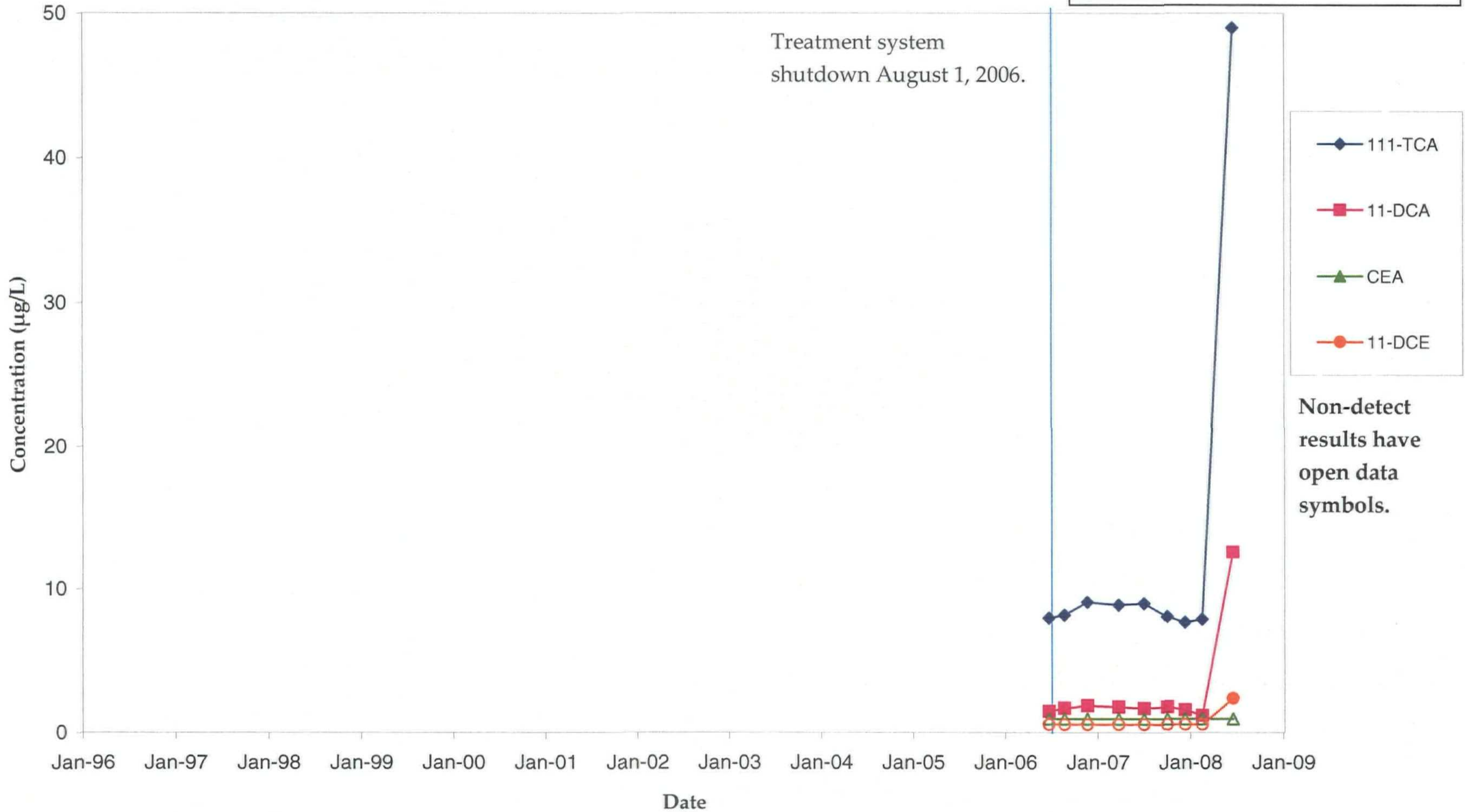
RM-213D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

5

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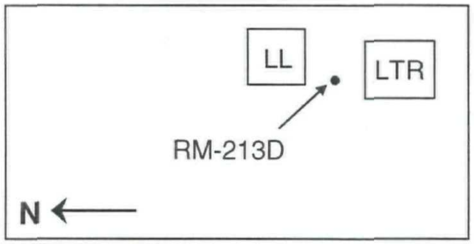
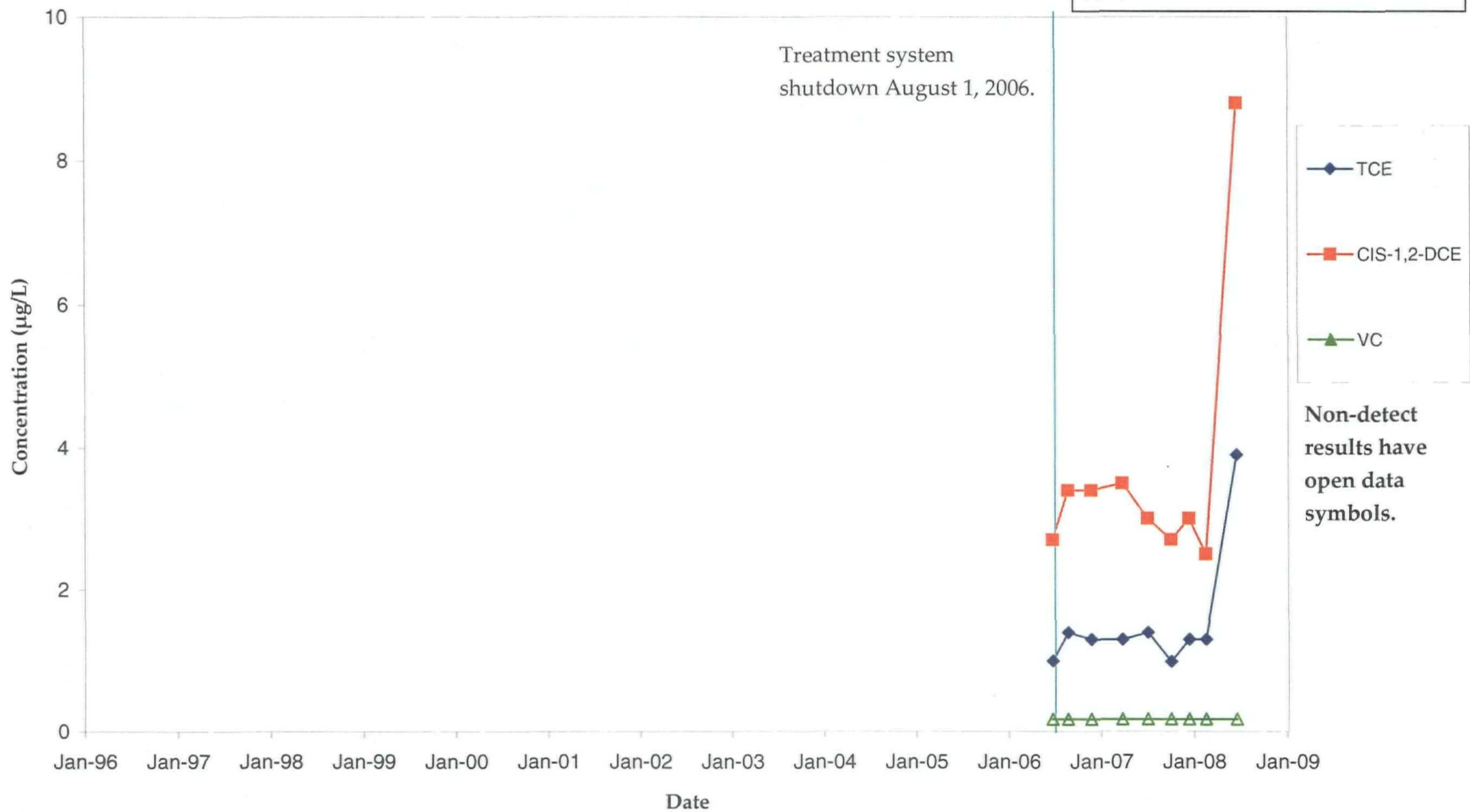
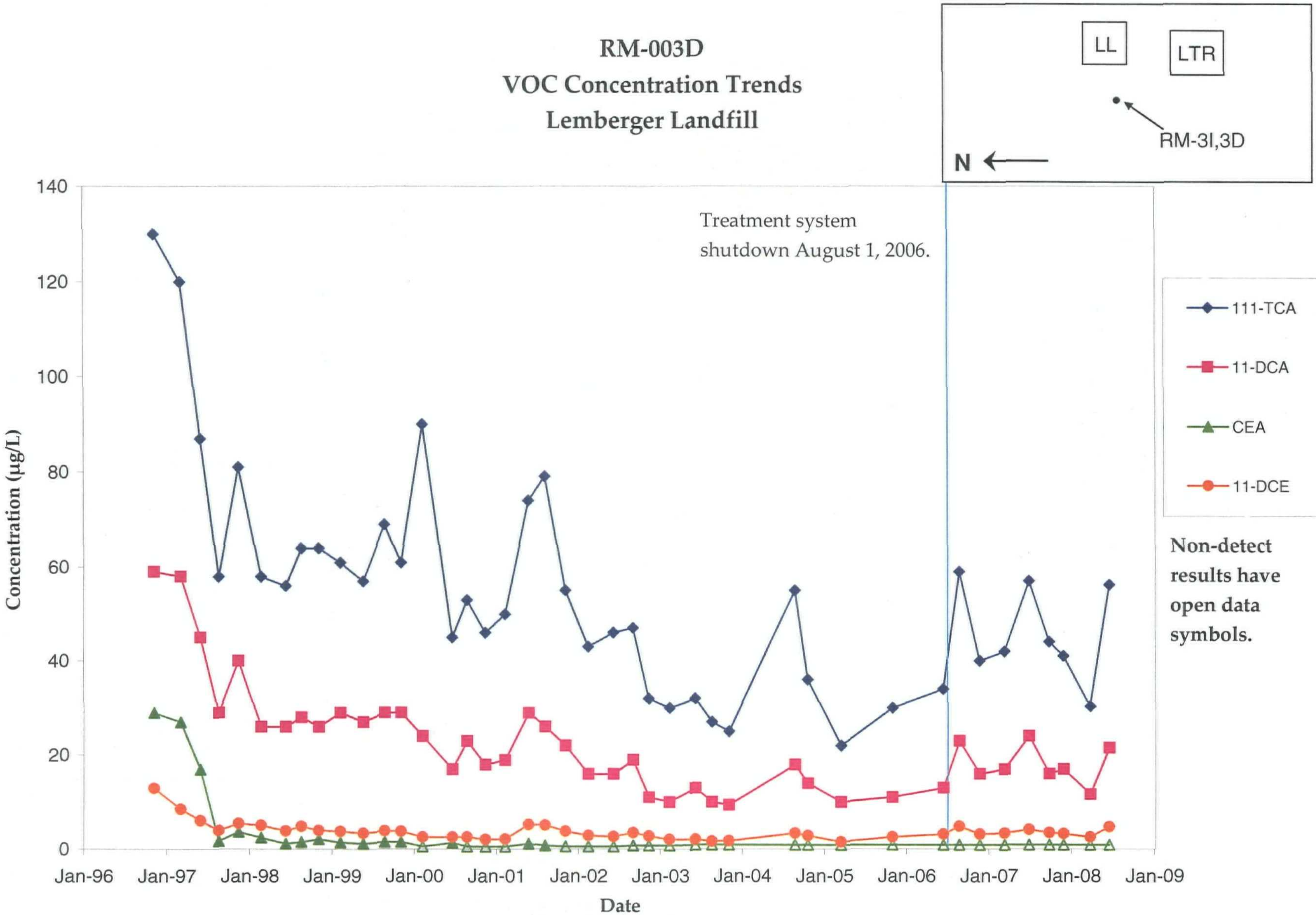
RM-213D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

16



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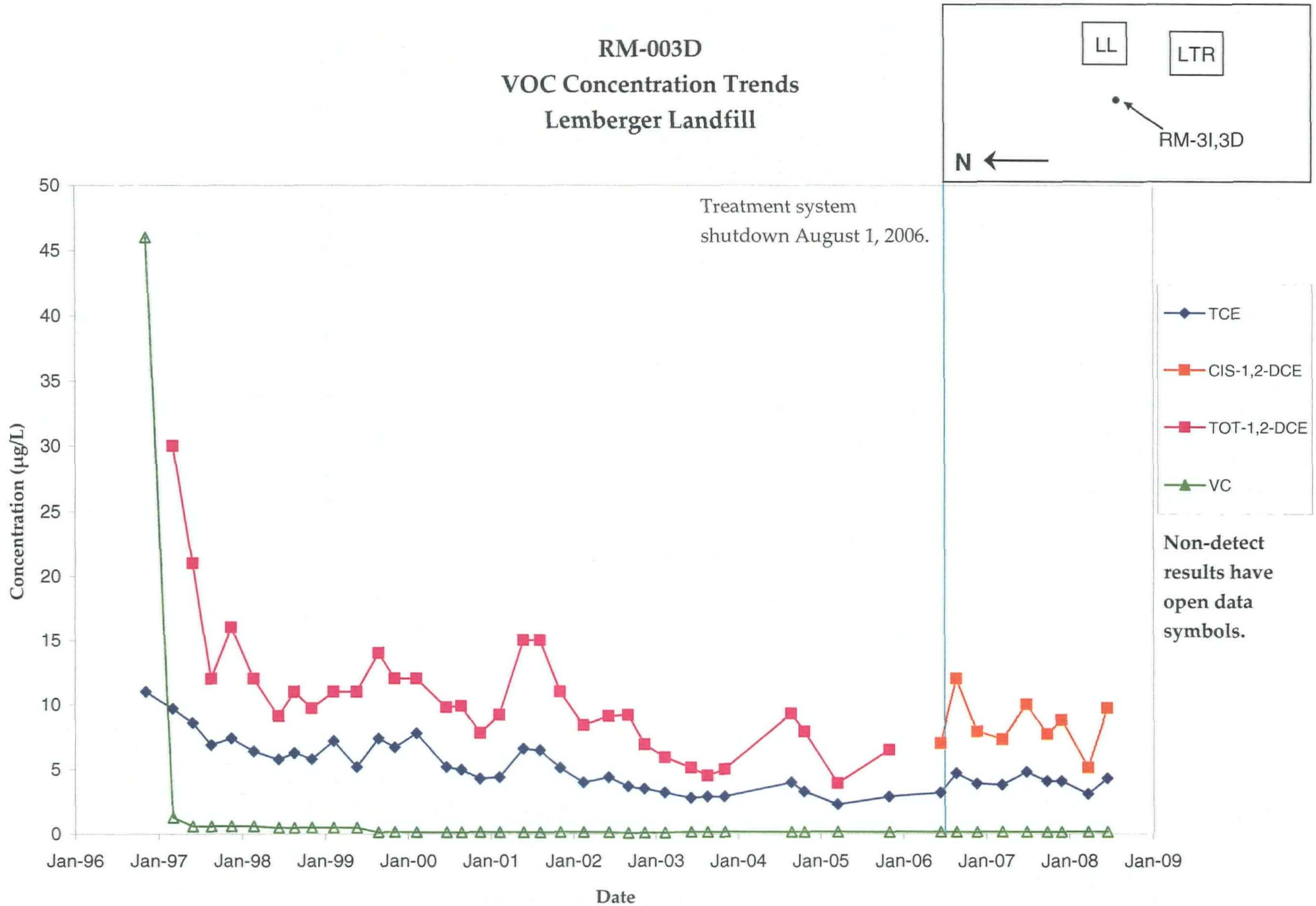

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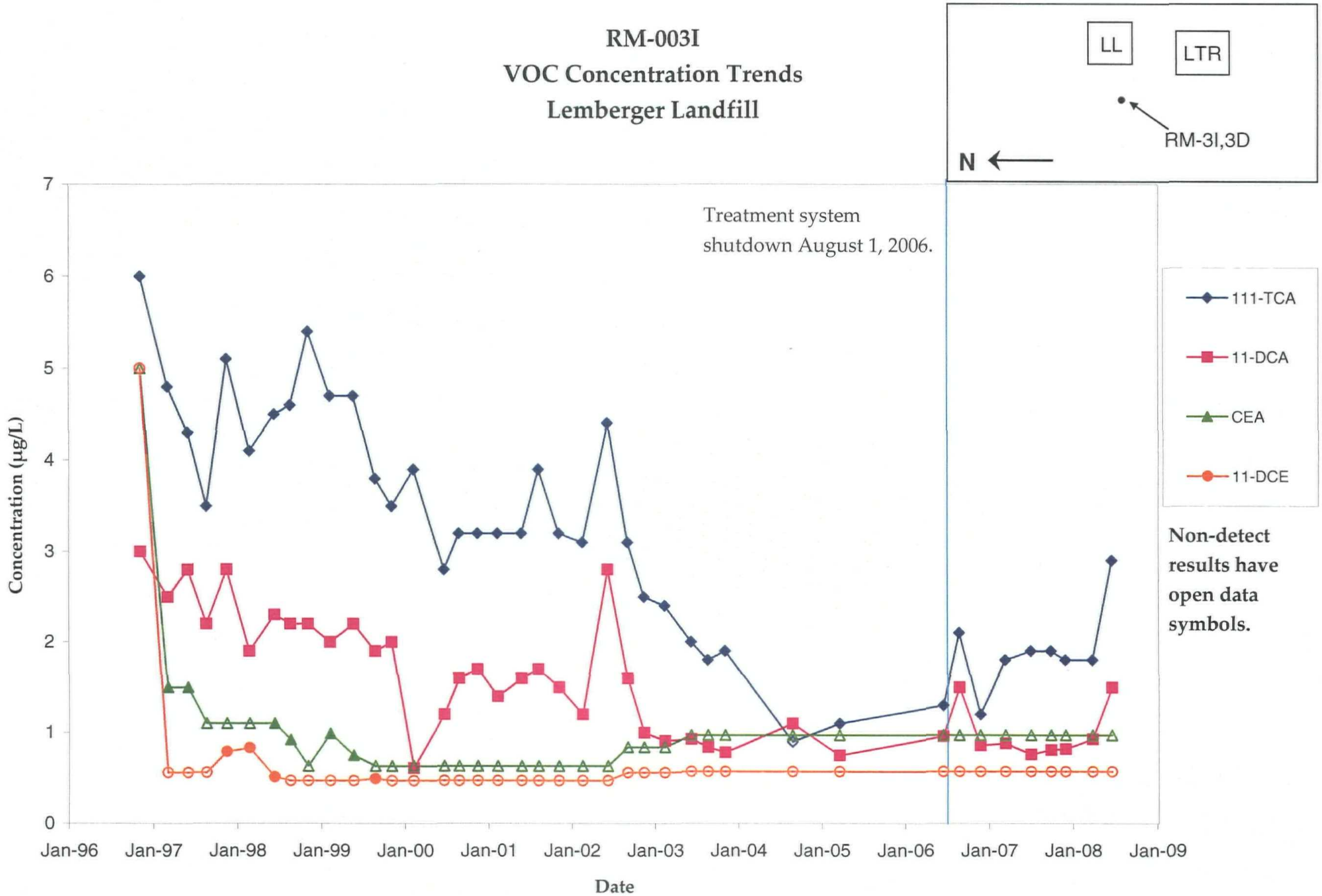
8

RM-003I
VOC Concentration Trends
Lemberger Landfill



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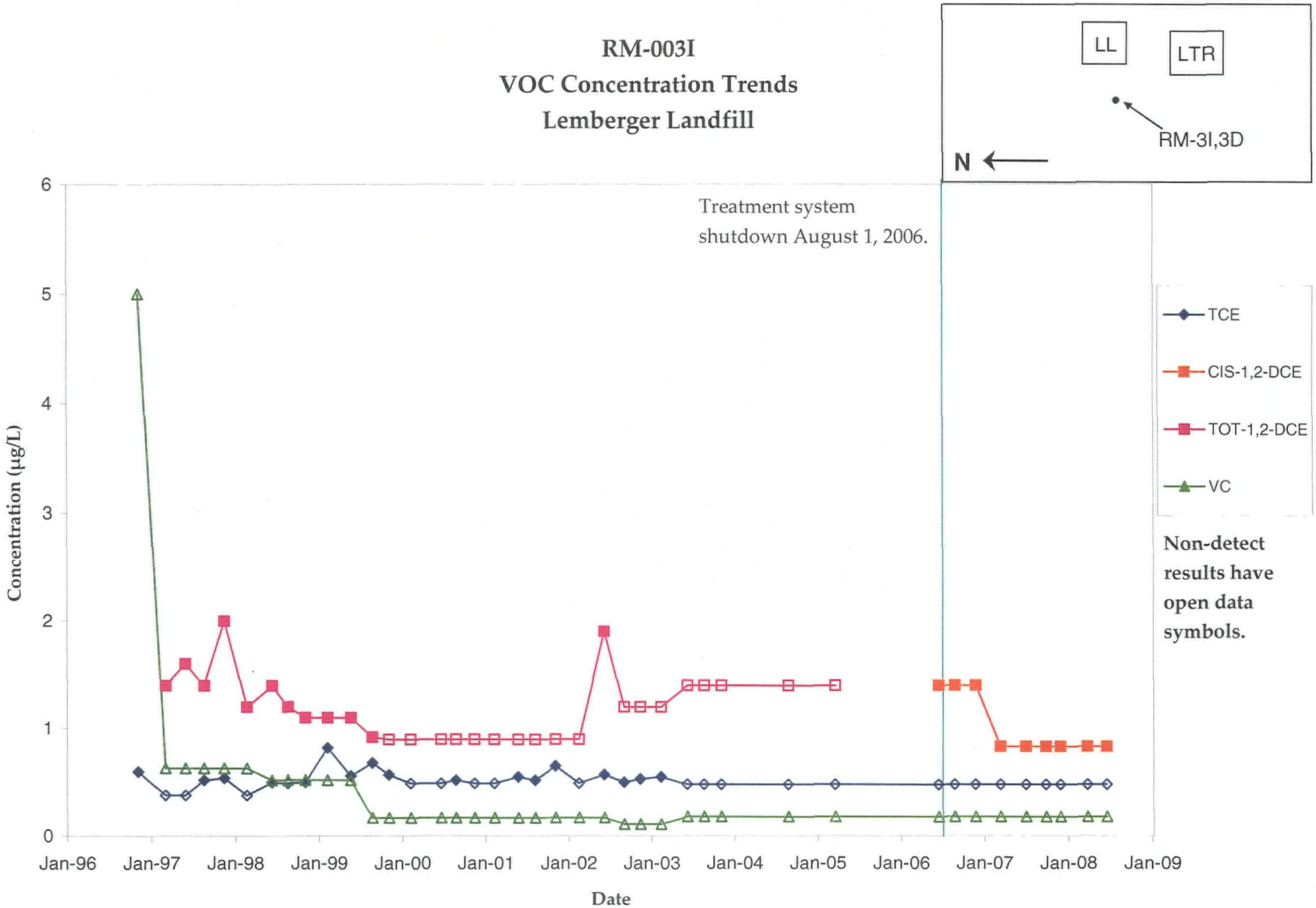
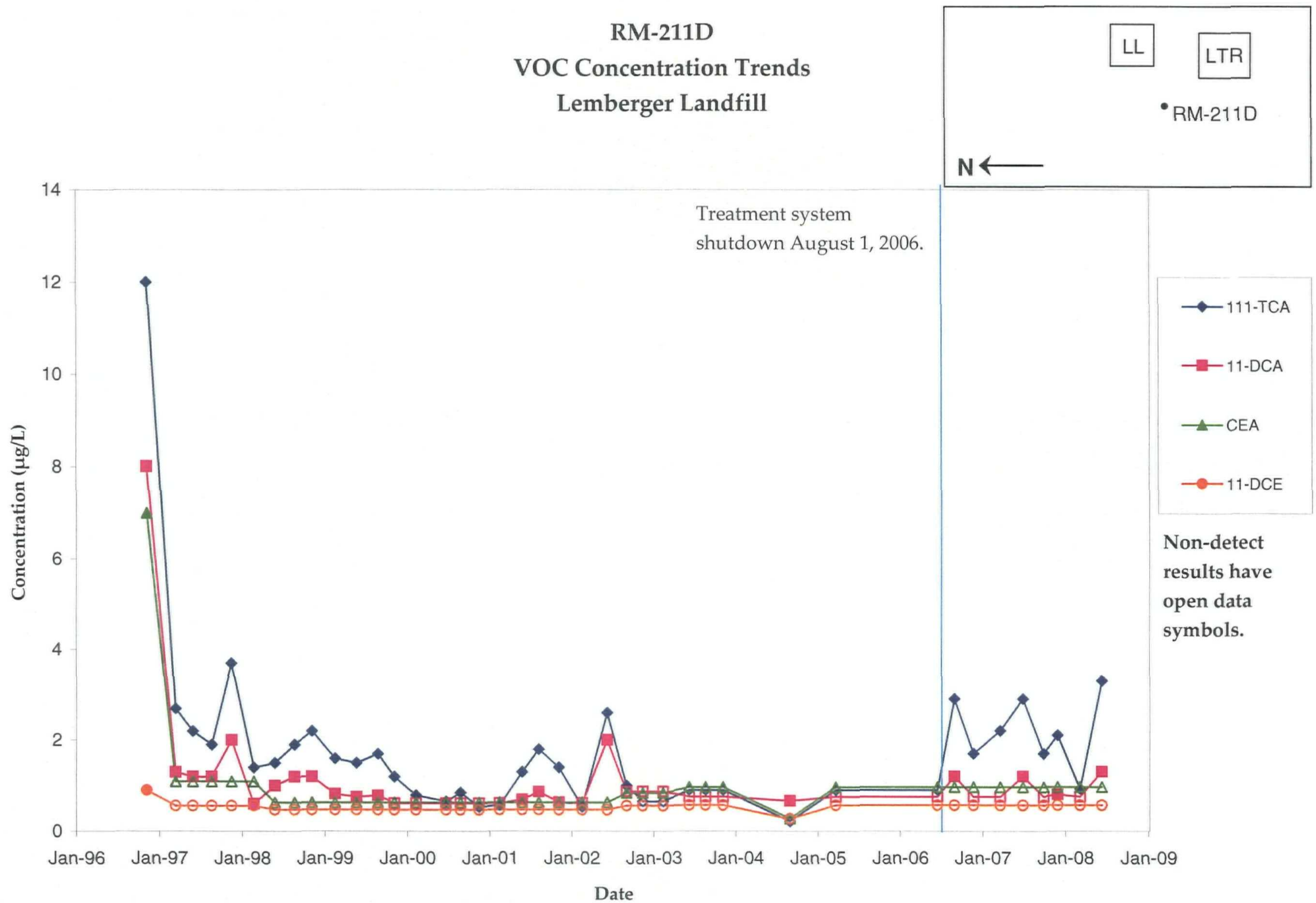
RM-003I
VOC Concentration Trends
Lemberger Landfill





12

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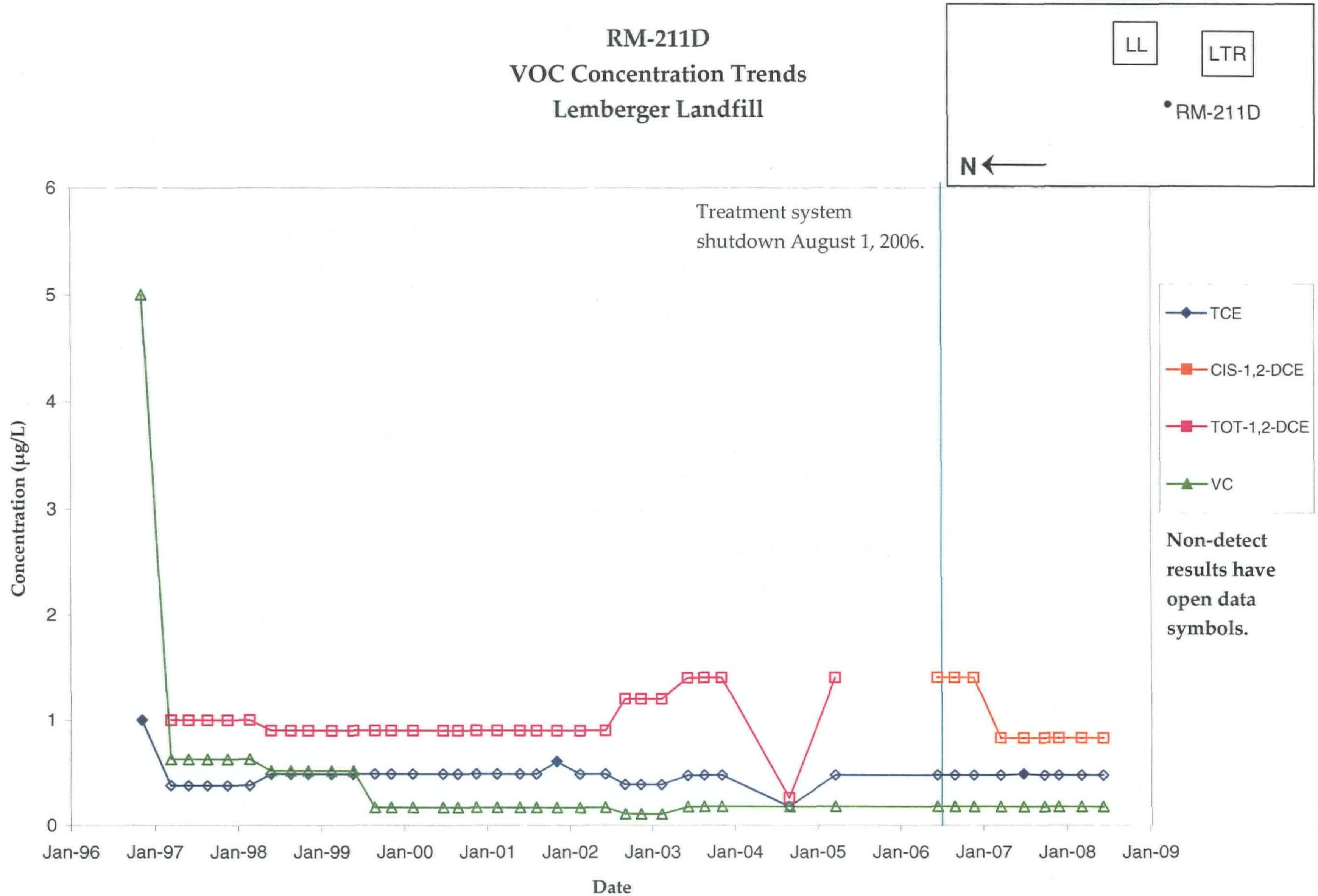

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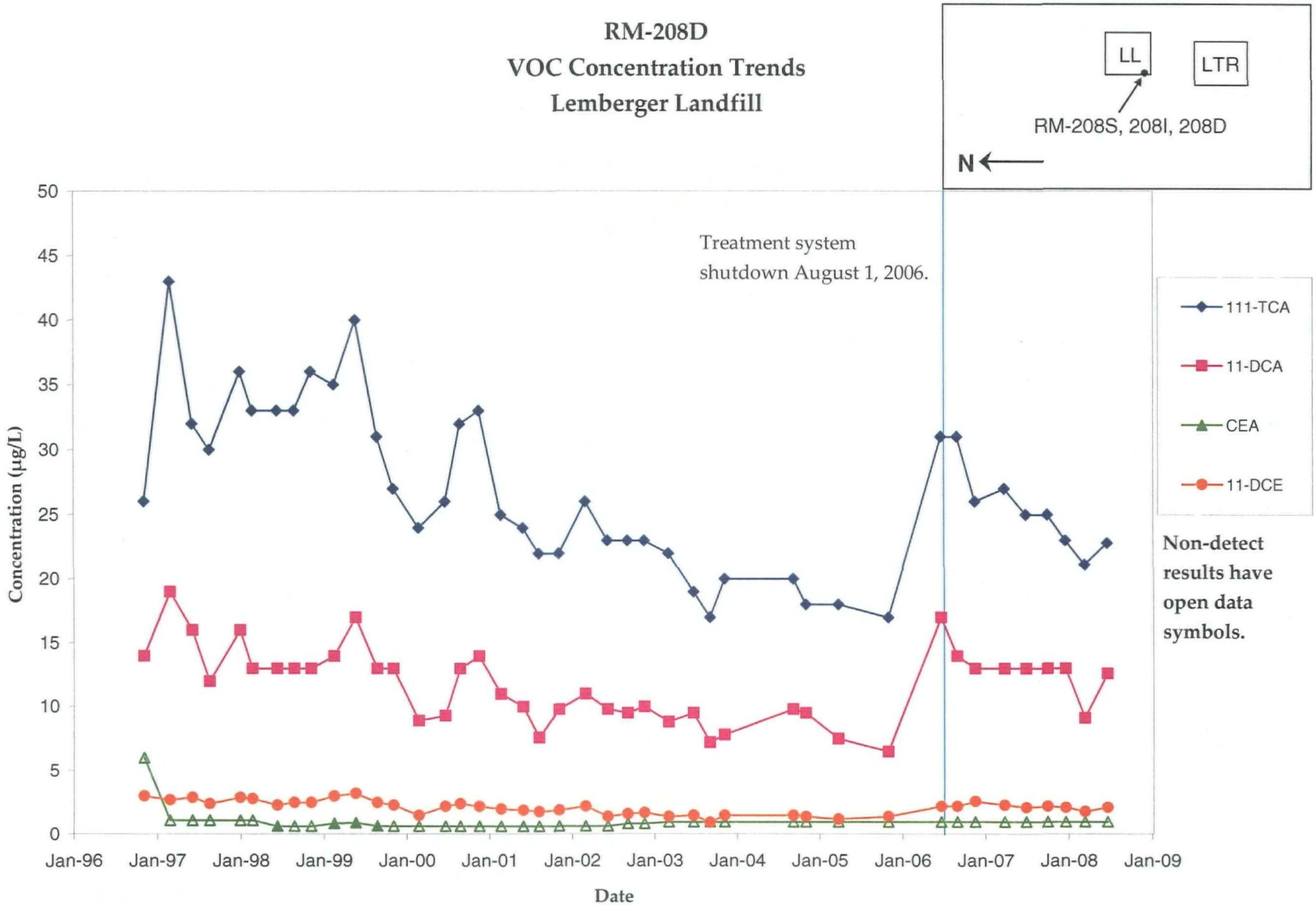

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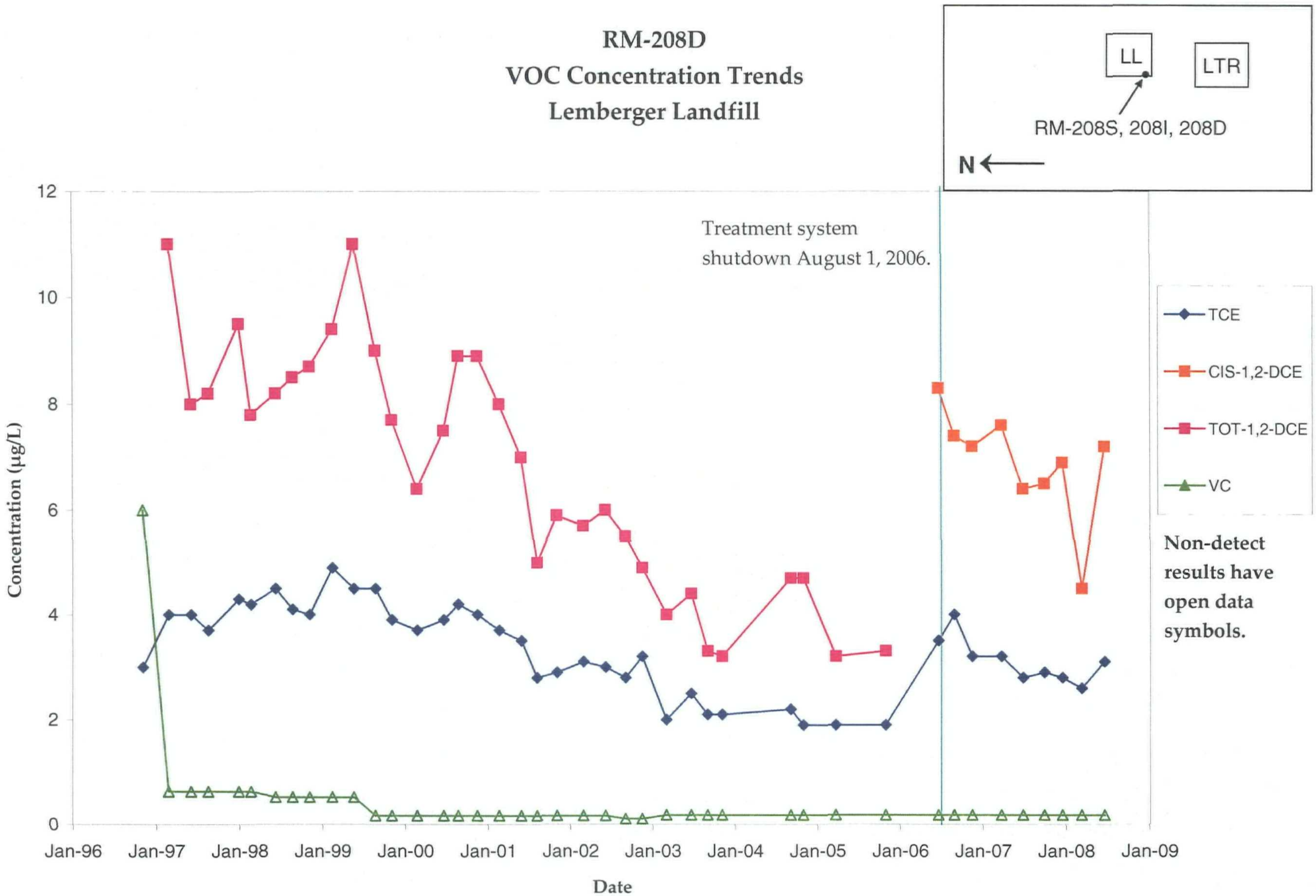

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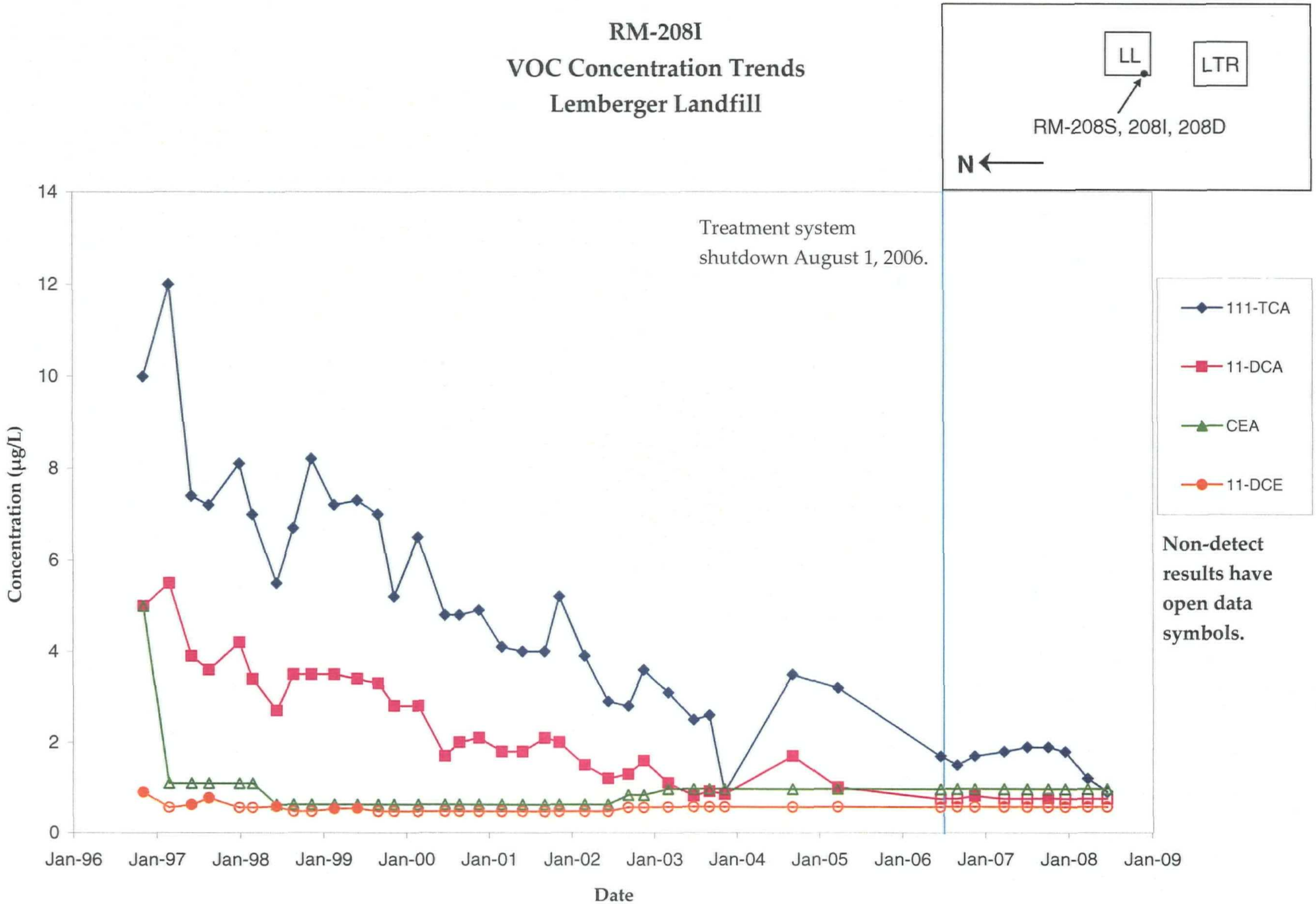

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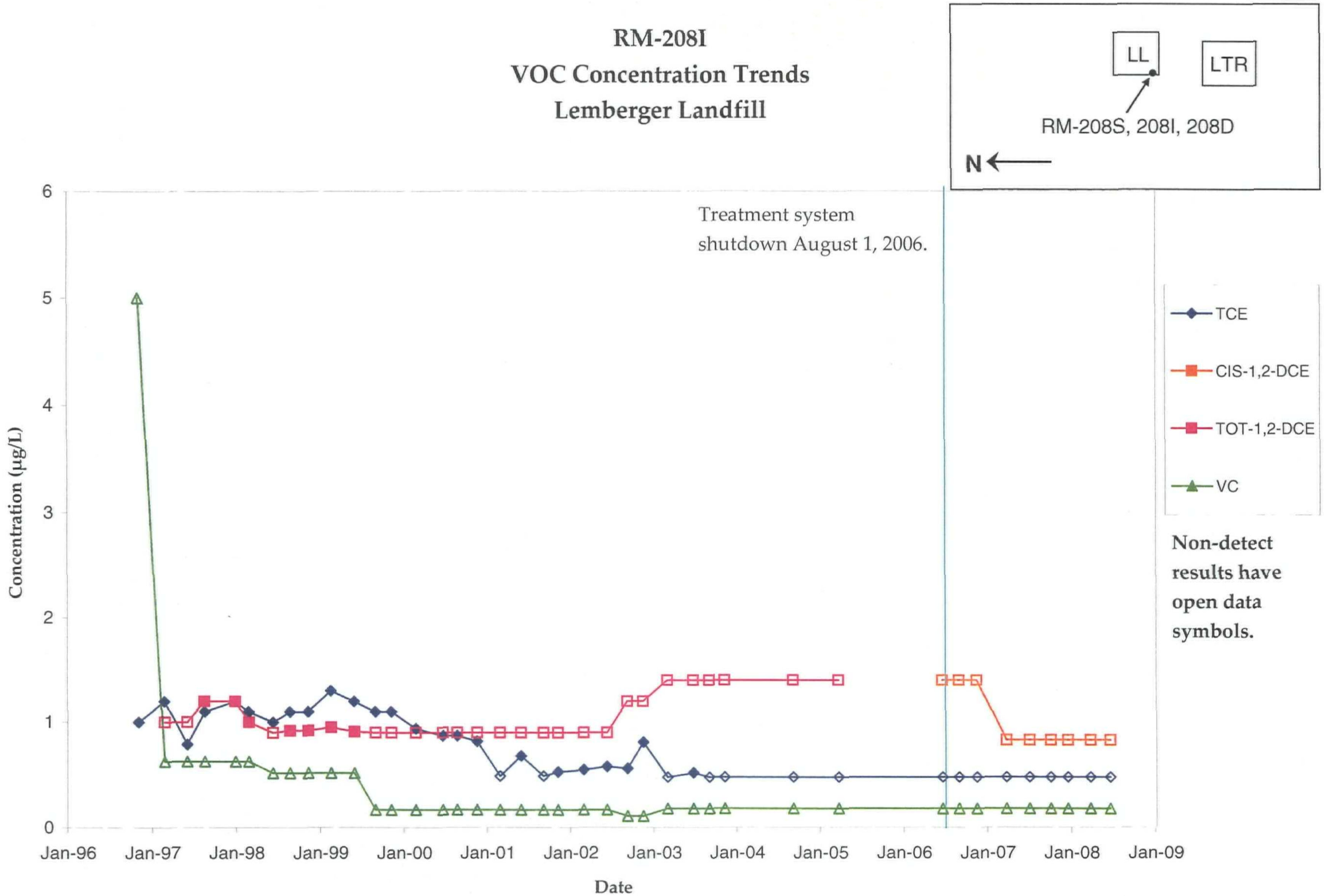

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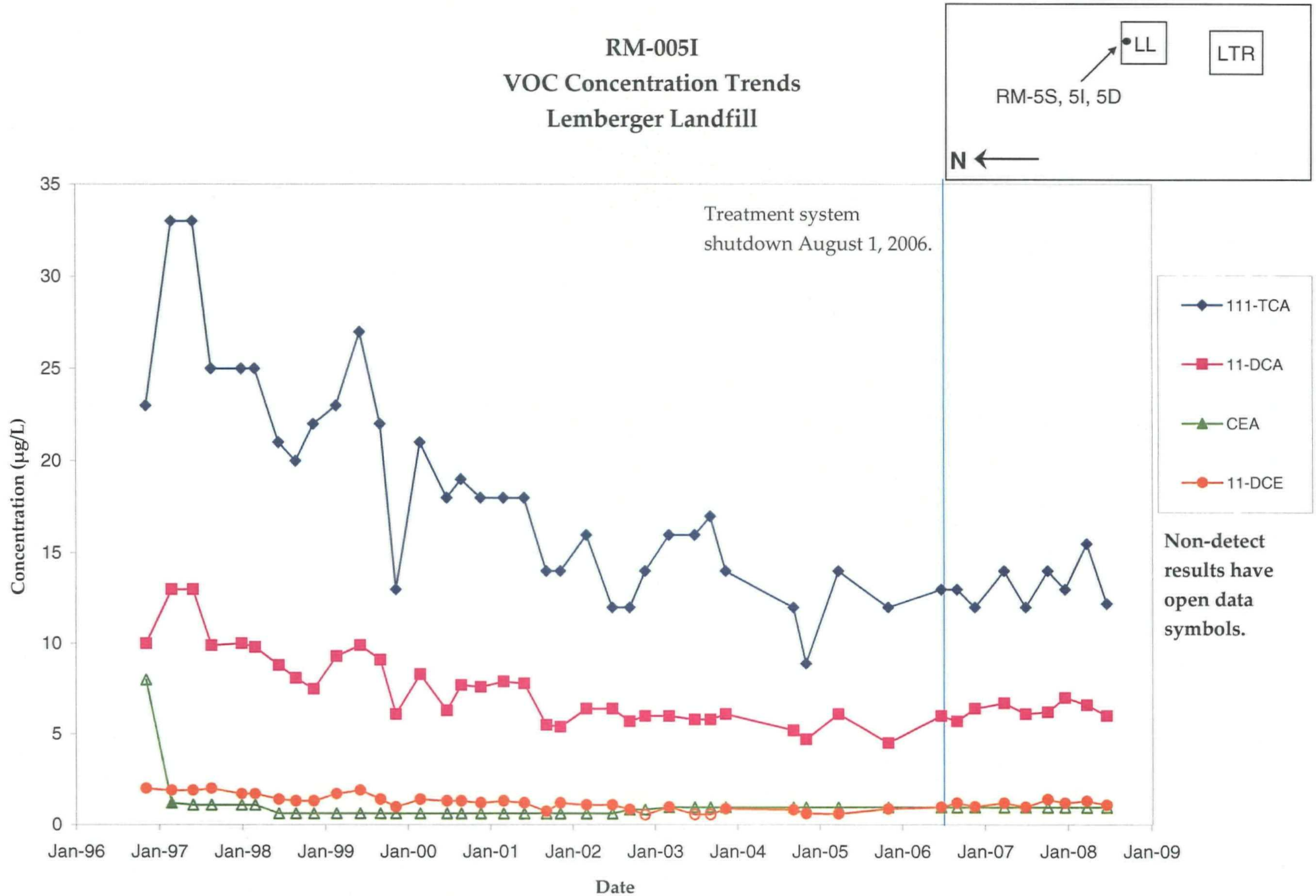
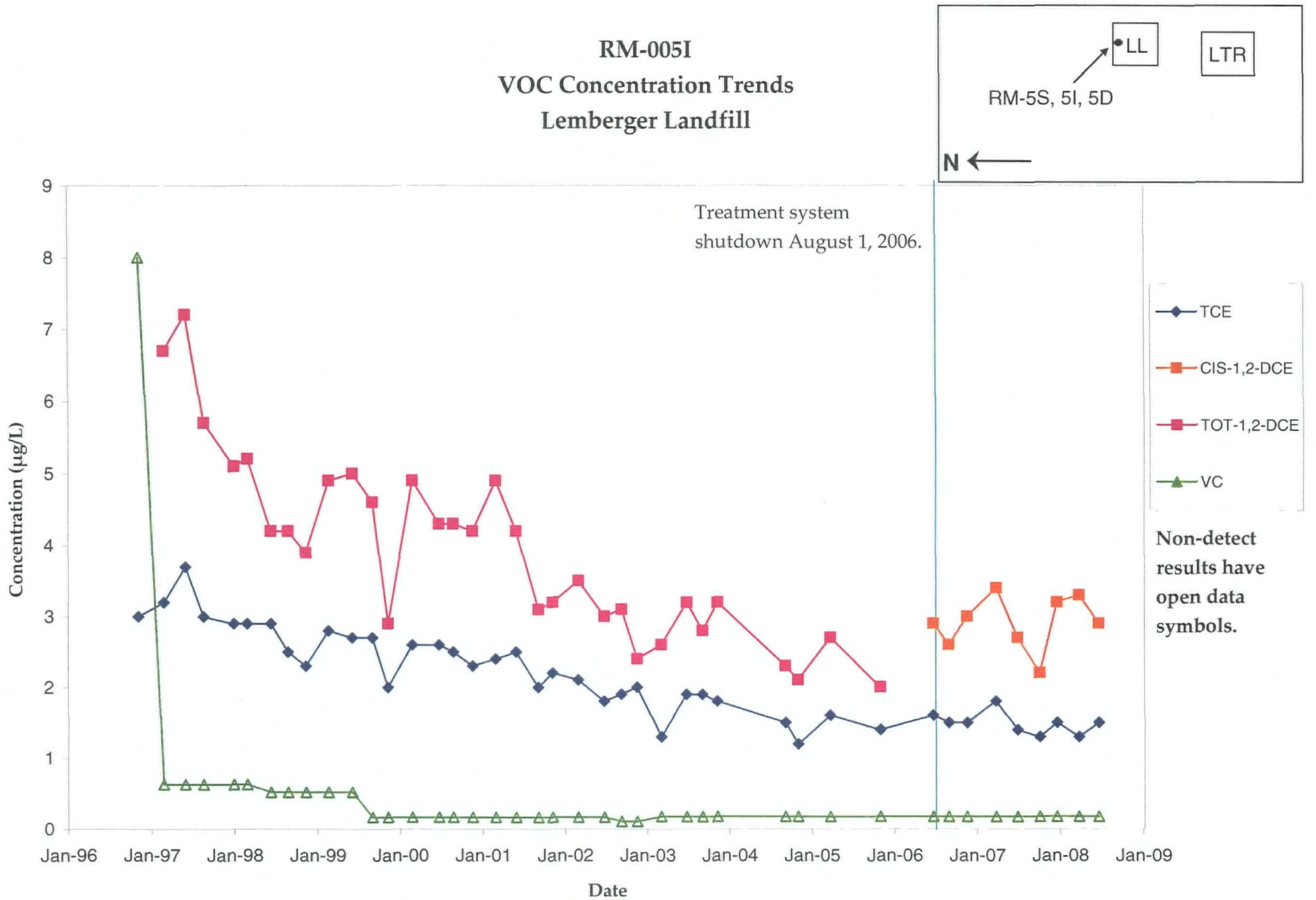
26

RM-005I
VOC Concentration Trends
Lemberger Landfill

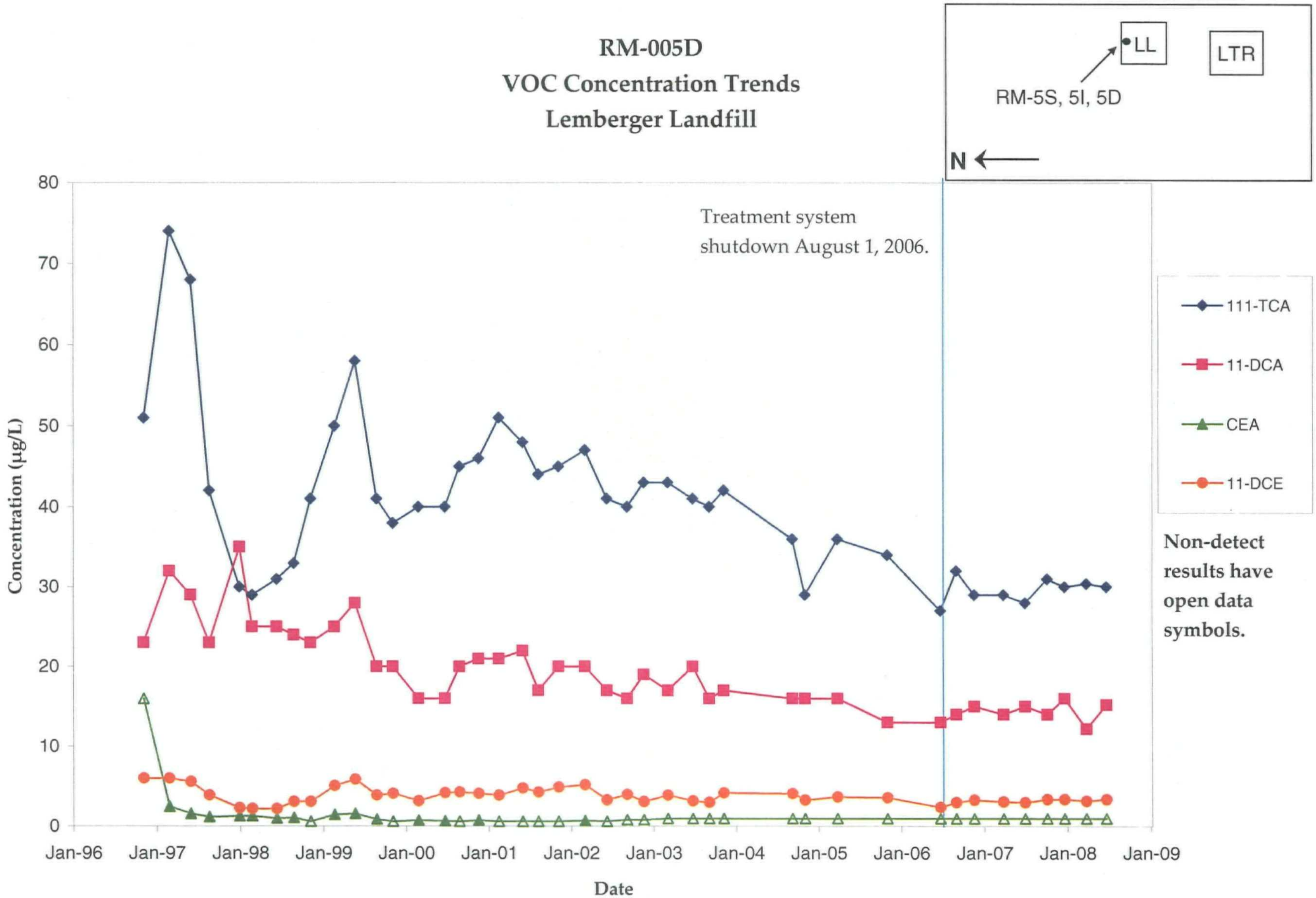


Non-detect results have open data symbols.

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

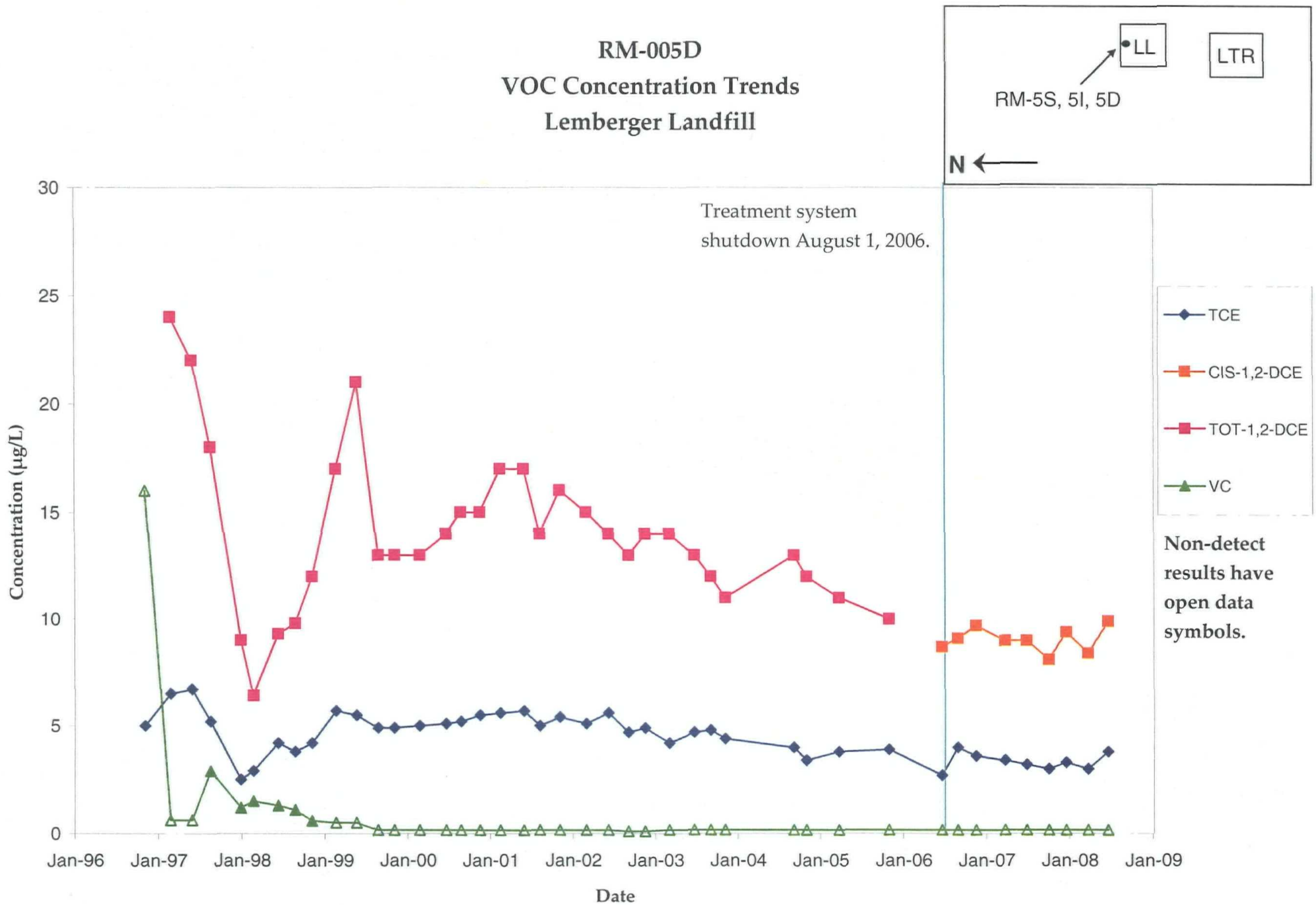


I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



39

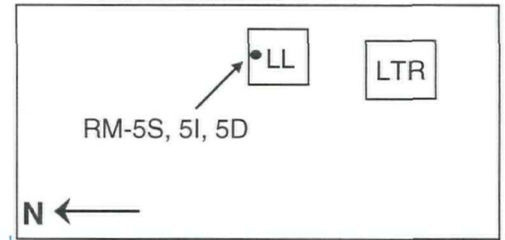
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

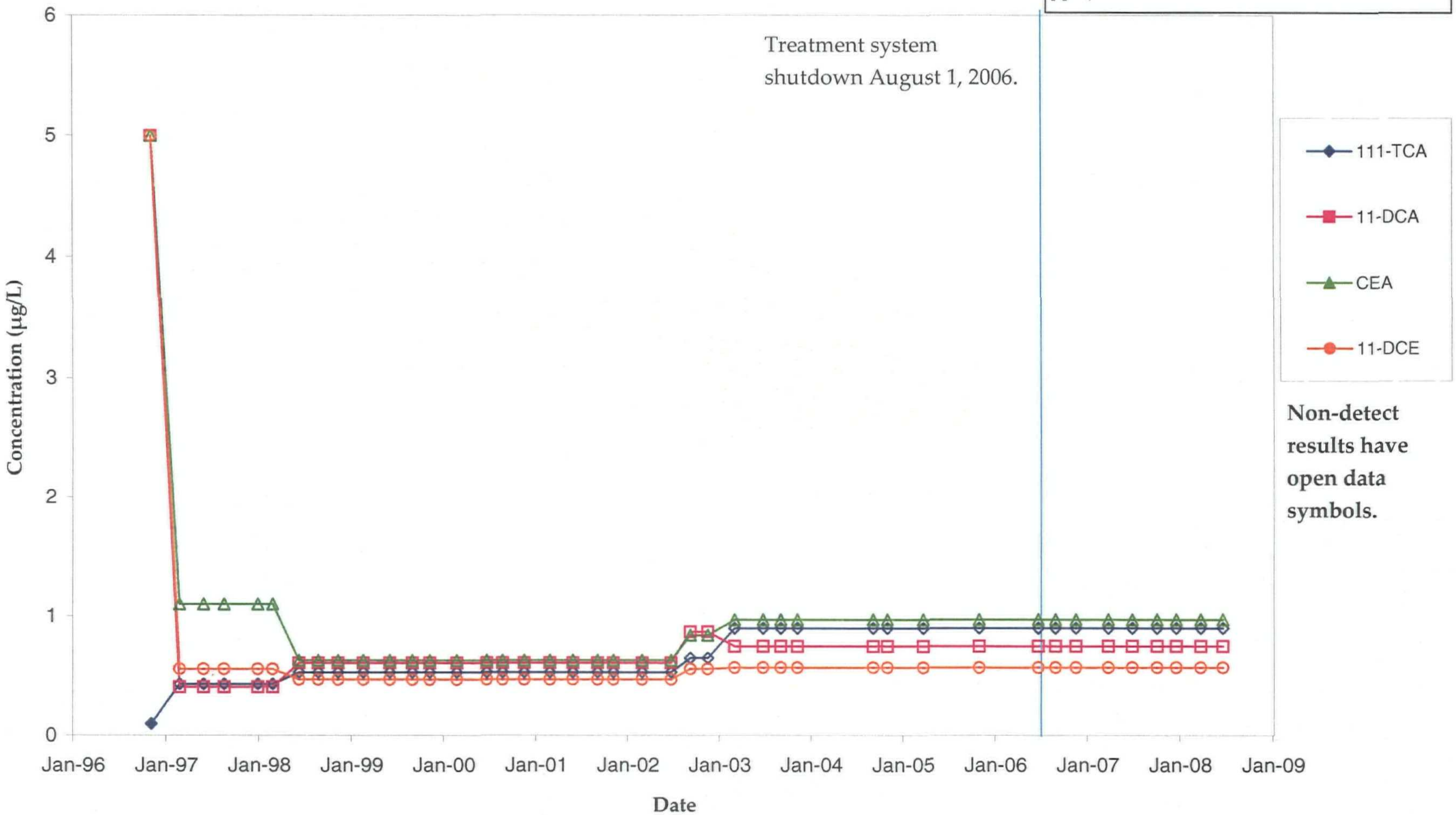


I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

30

RM-005S
VOC Concentration Trends
Lemberger Landfill

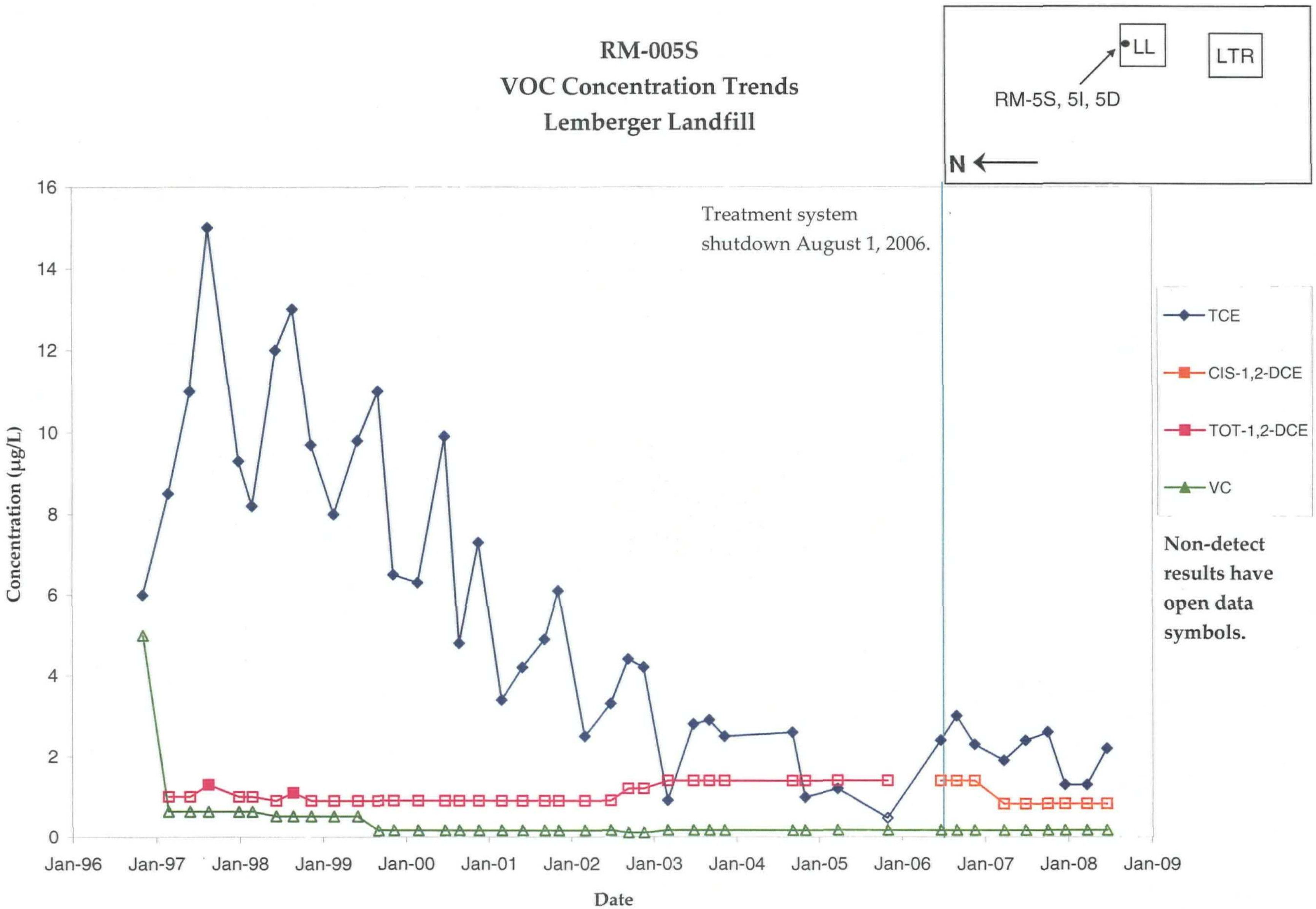




Non-detect results have open data symbols.

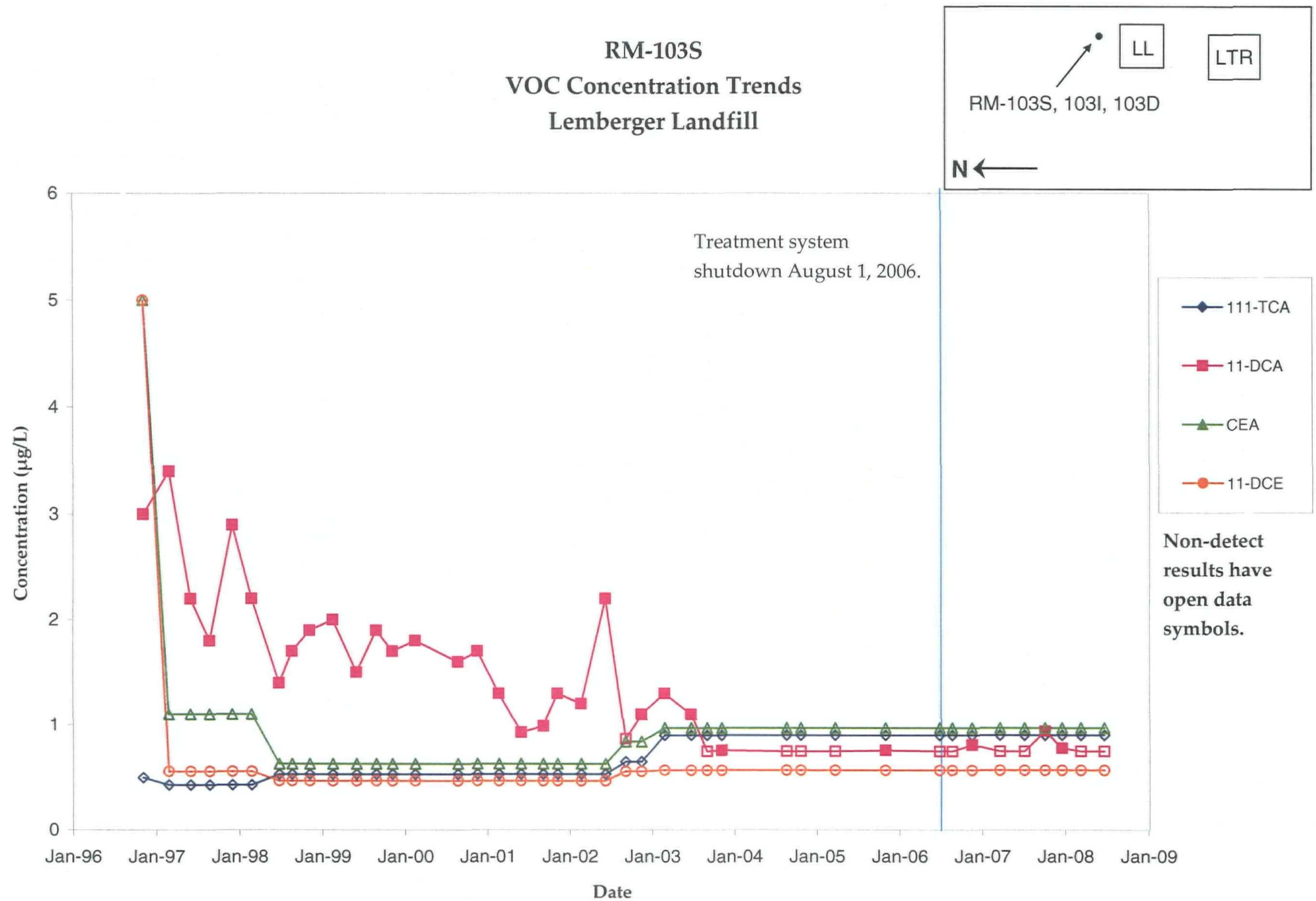
3

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

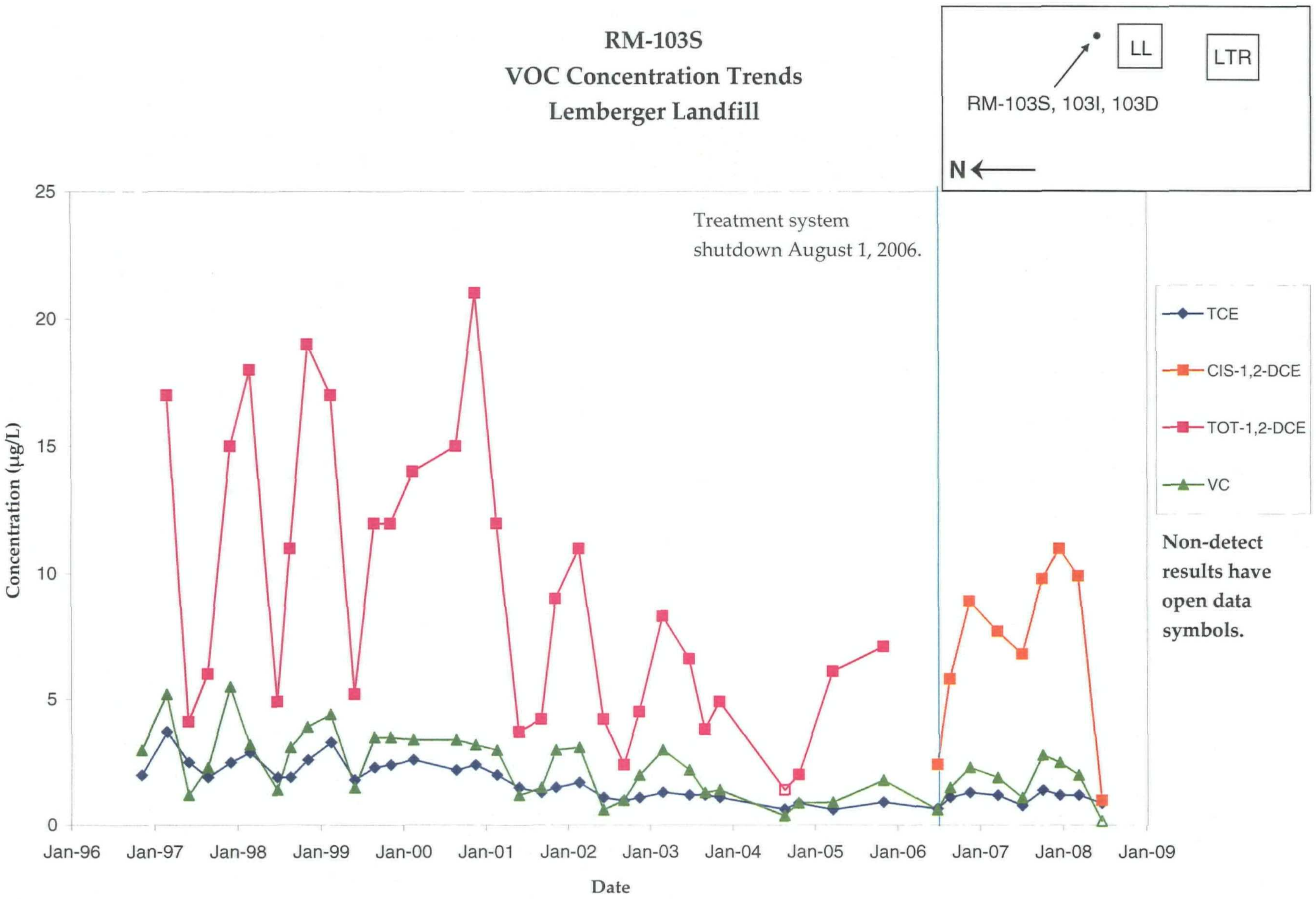


32

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

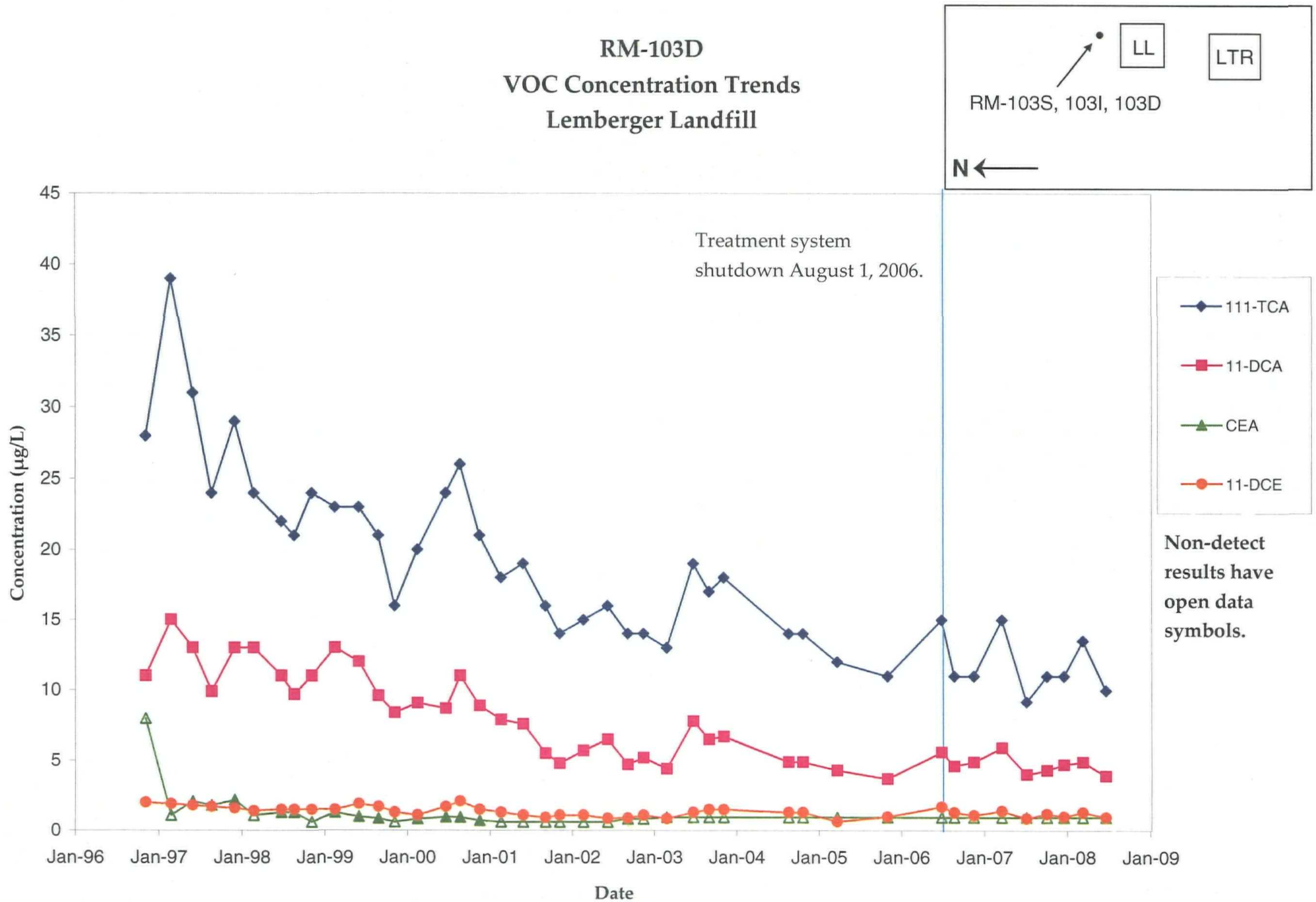

RM-103S
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-103S, 103I, 103D
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
Date
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09

35



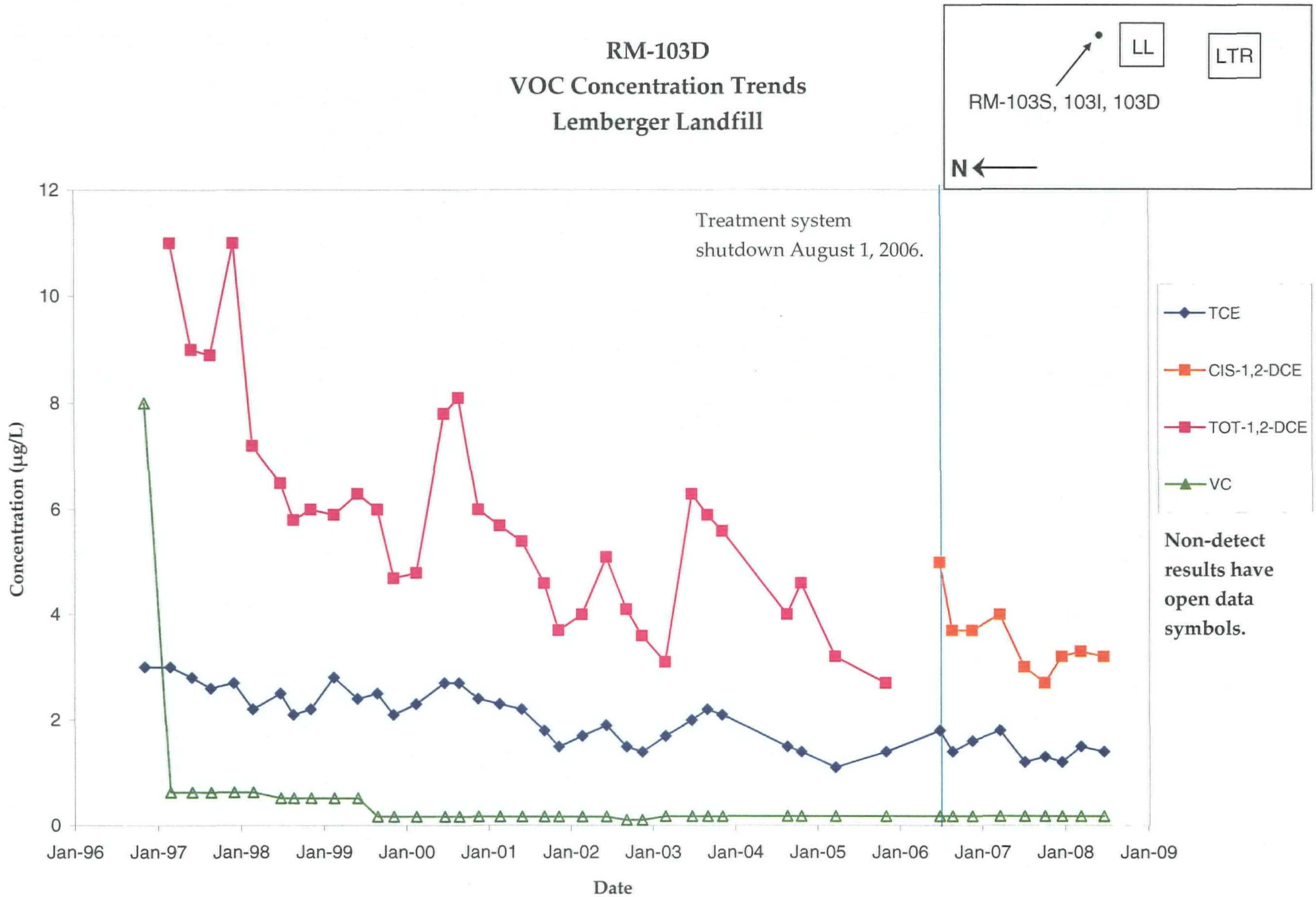
36

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



33

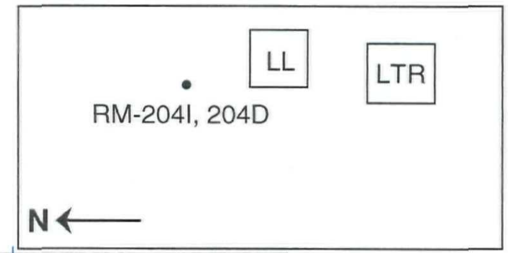
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

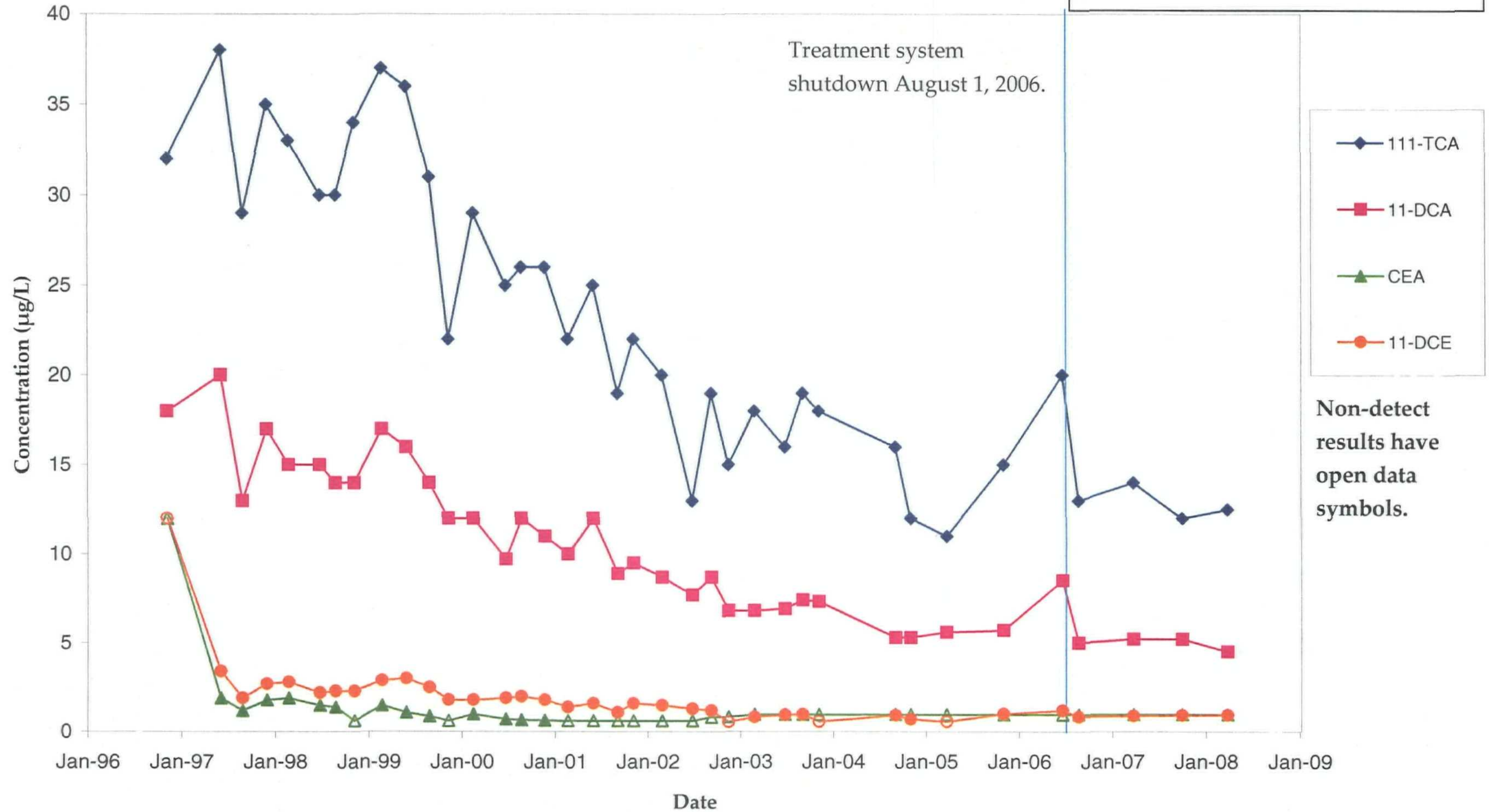


34

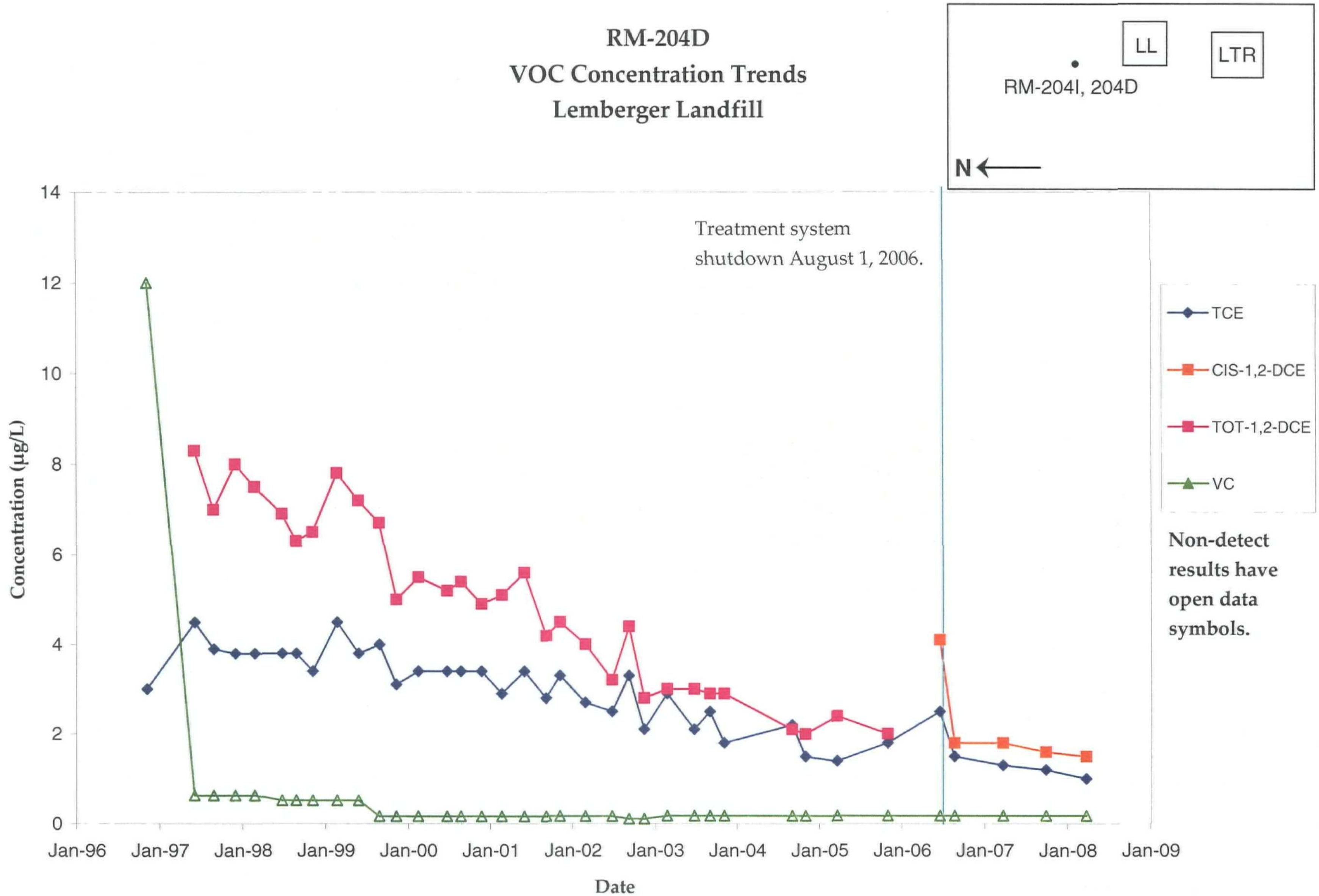
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

RM-204D
VOC Concentration Trends
Lemberger Landfill

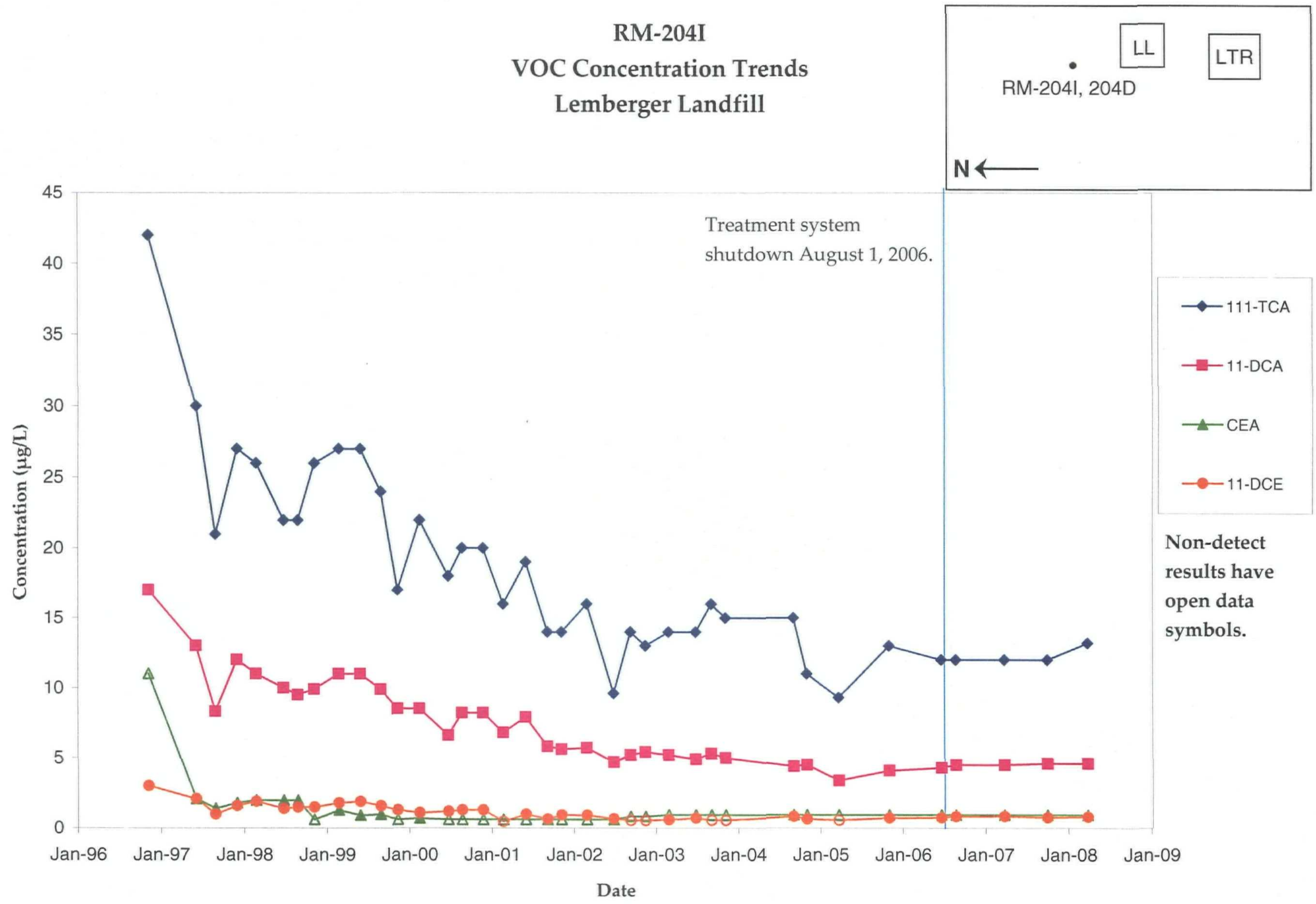




37


RM-204D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-204I, 204D
N
Treatment system
shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.
Concentration (µg/L)
14
12
10
8
6
4
2
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date

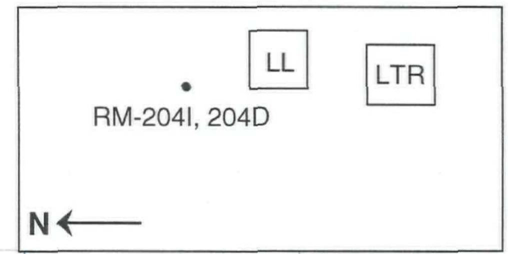
38

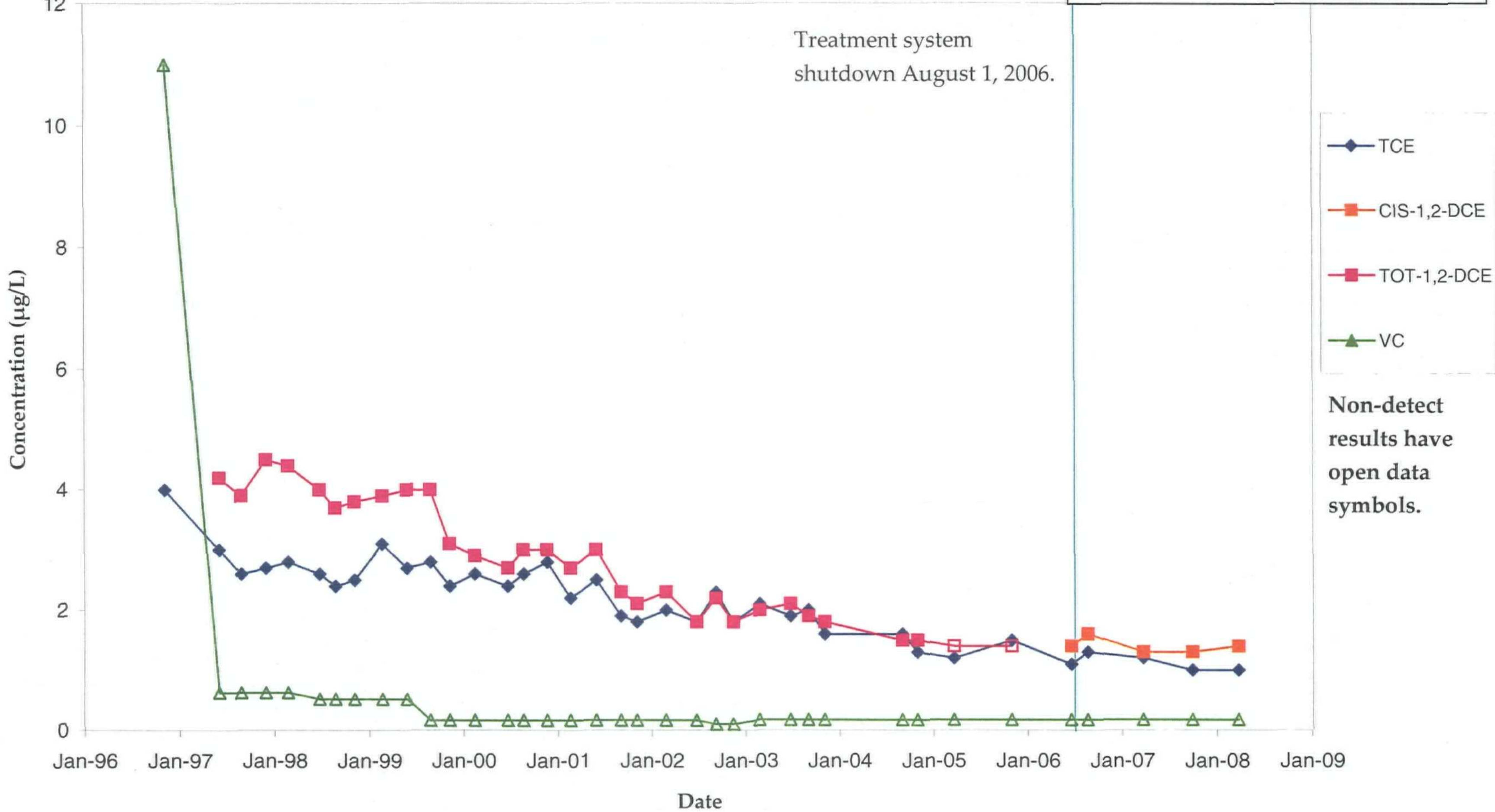


39

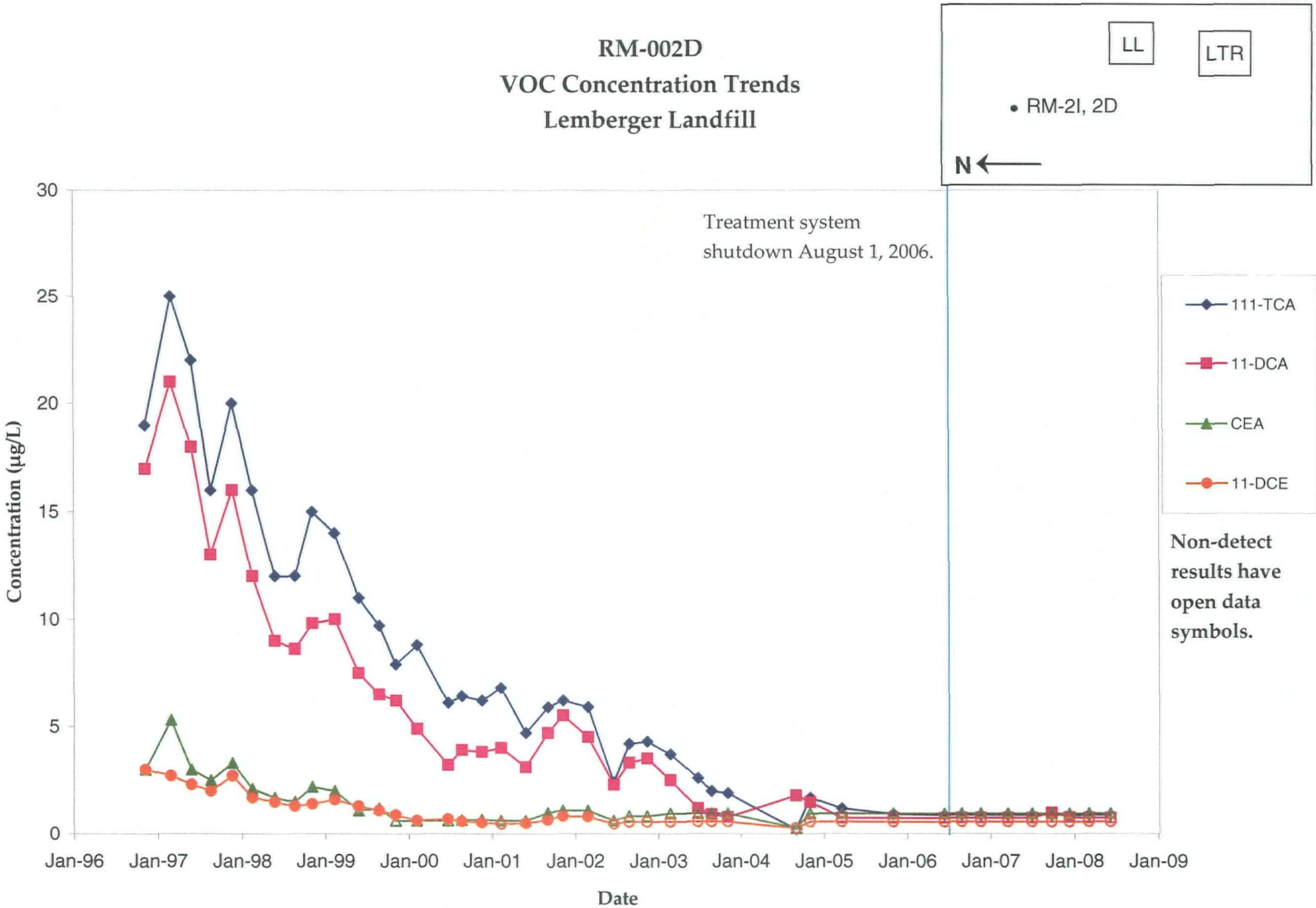
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

RM-204I
VOC Concentration Trends
Lemberger Landfill



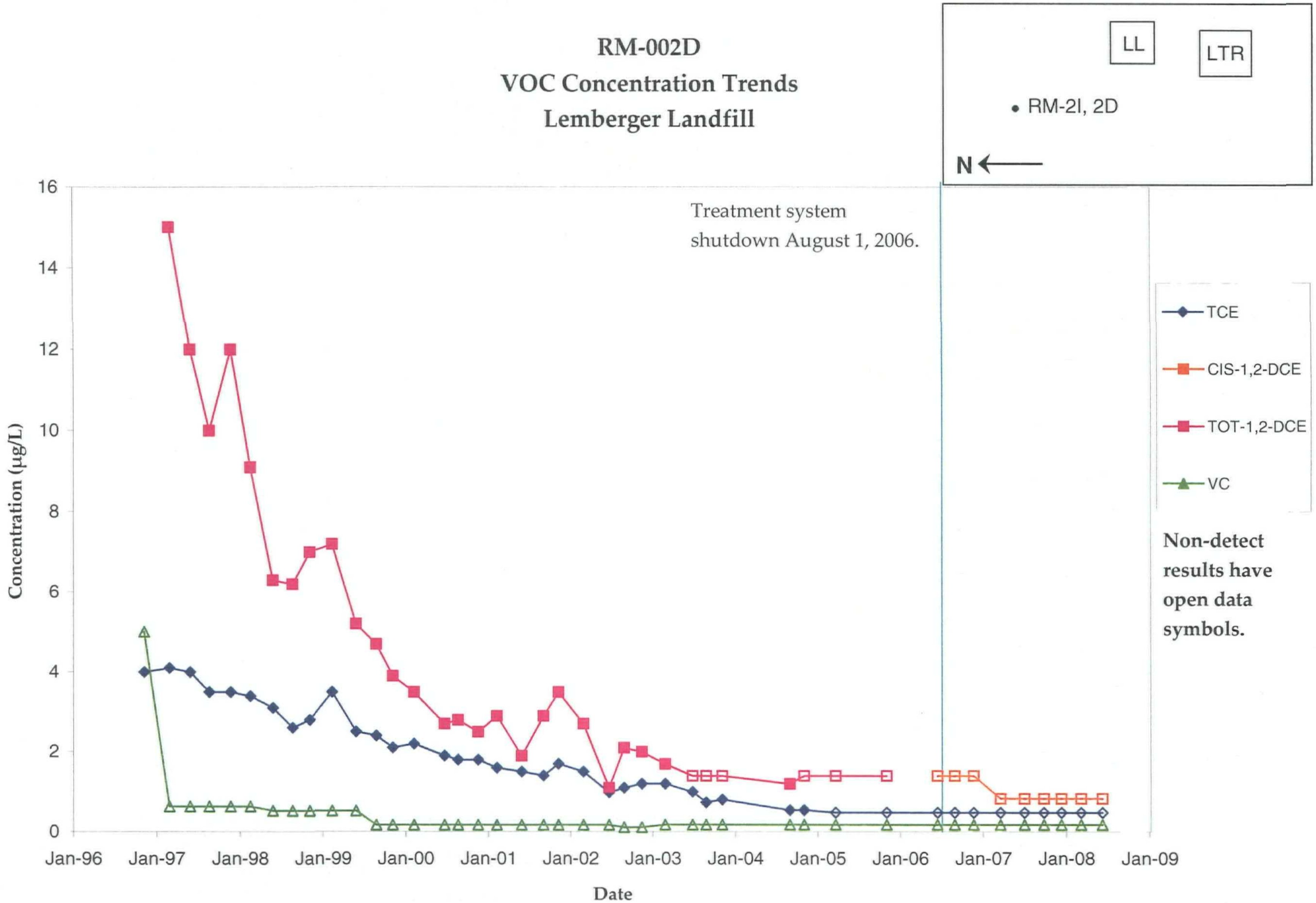


I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



47

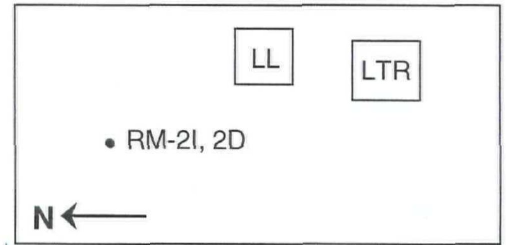
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

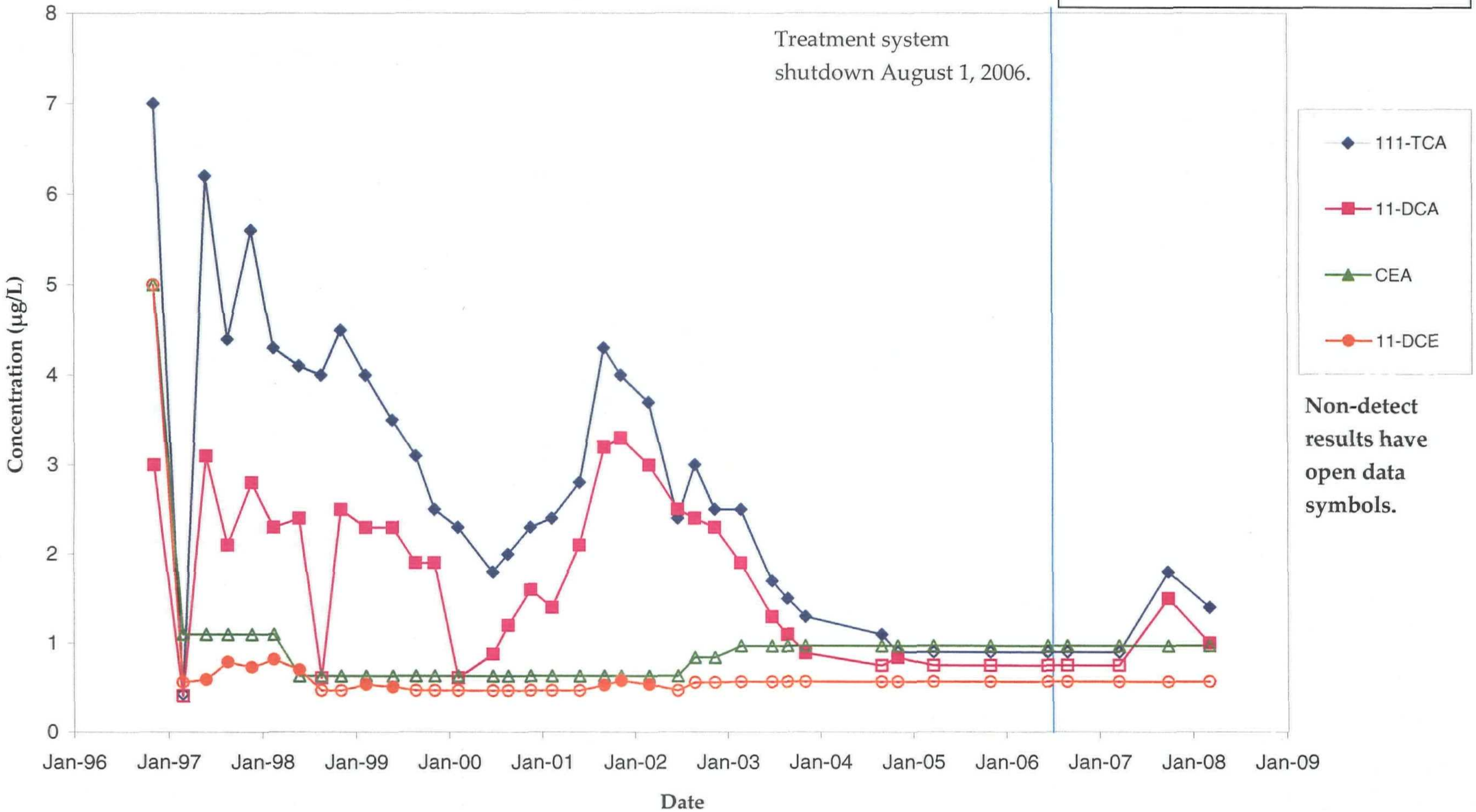


ch

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

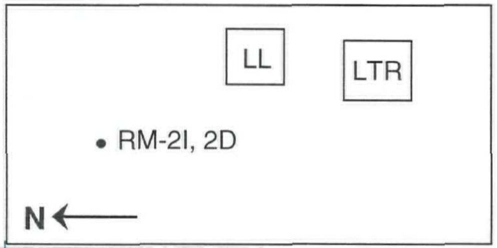
RM-002I
VOC Concentration Trends
Lemberger Landfill

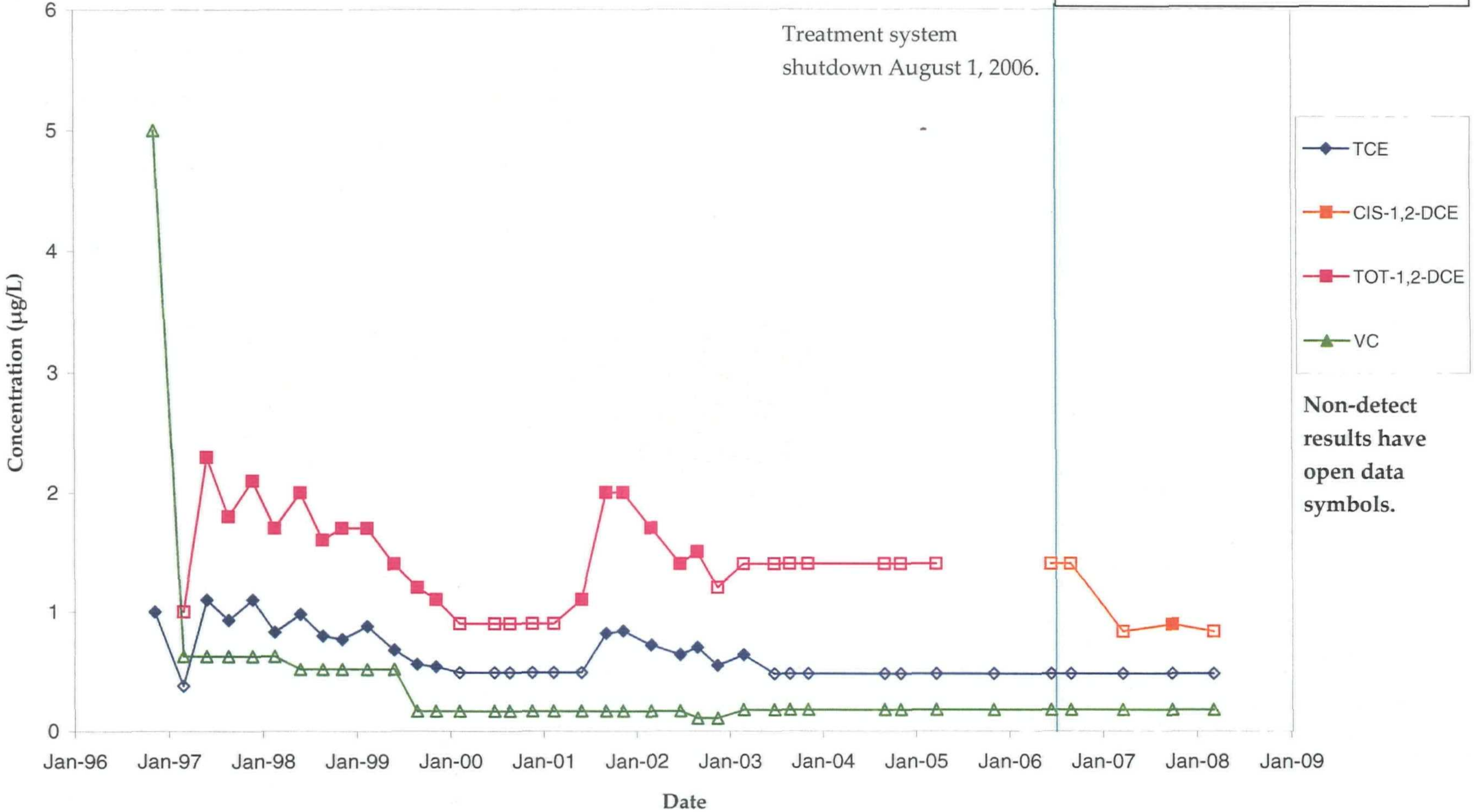




I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

RM-002I
VOC Concentration Trends
Lemberger Landfill

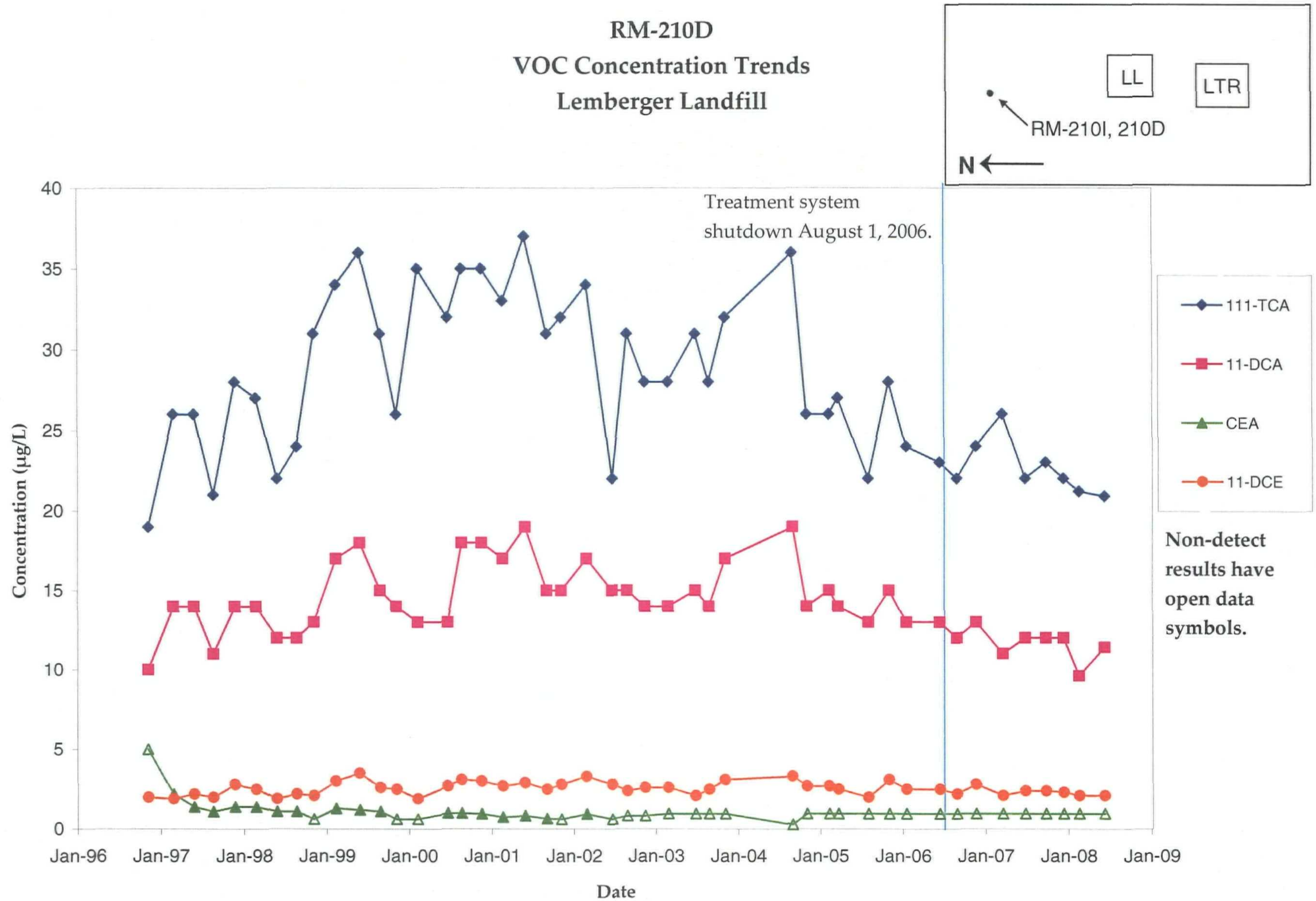




Non-detect results have open data symbols.

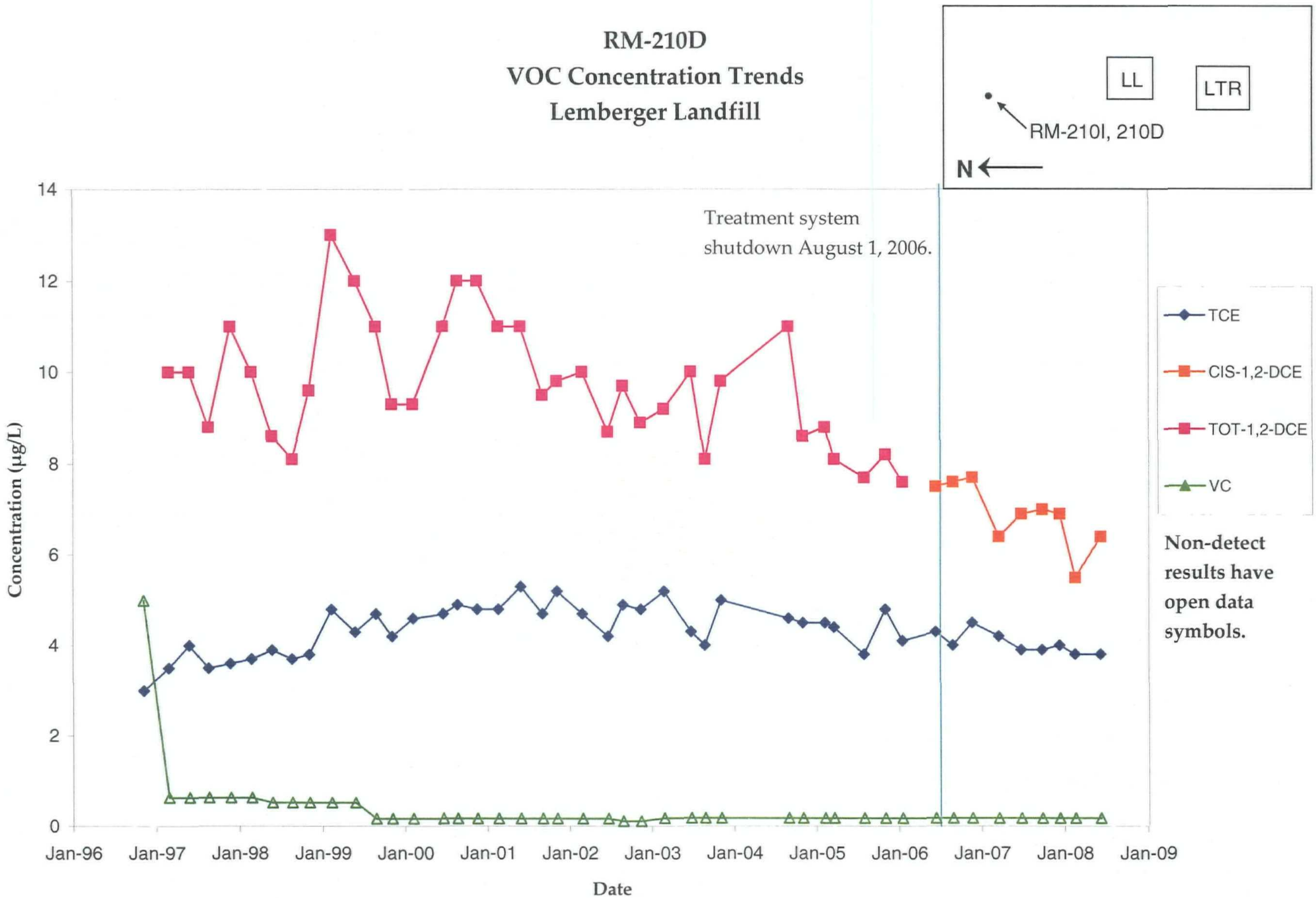
44

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



45

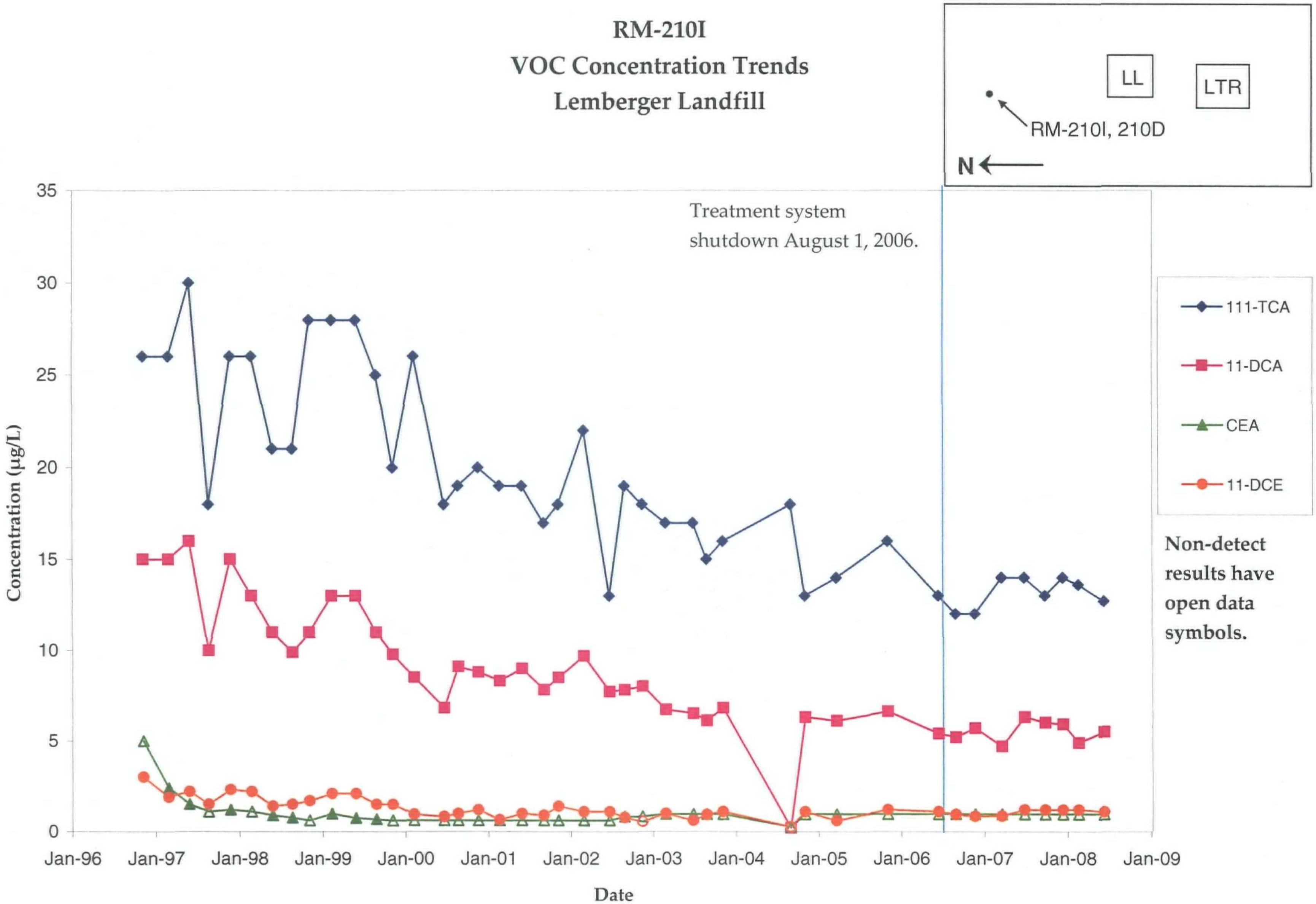
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



46

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

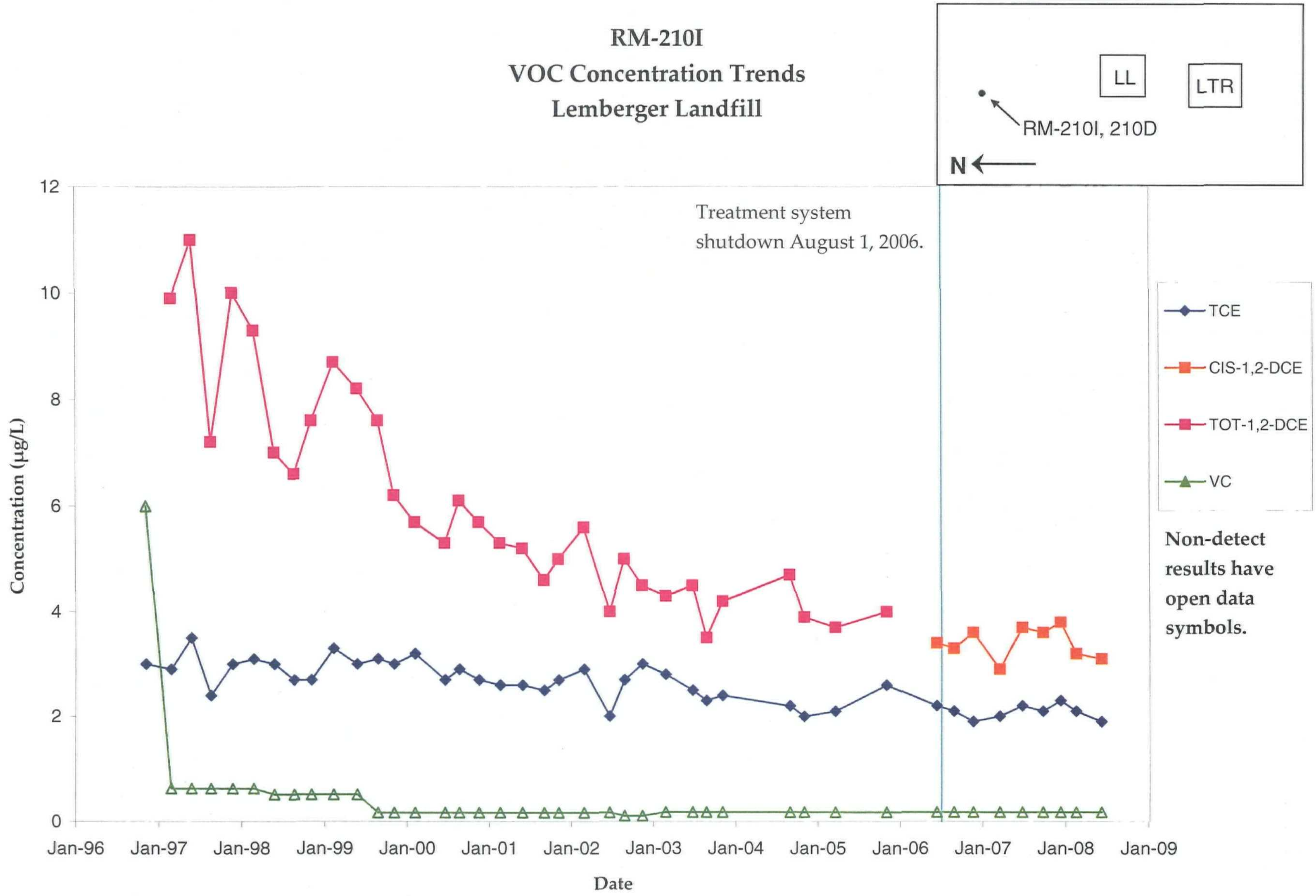
RM-210I
VOC Concentration Trends
Lemberger Landfill



47

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

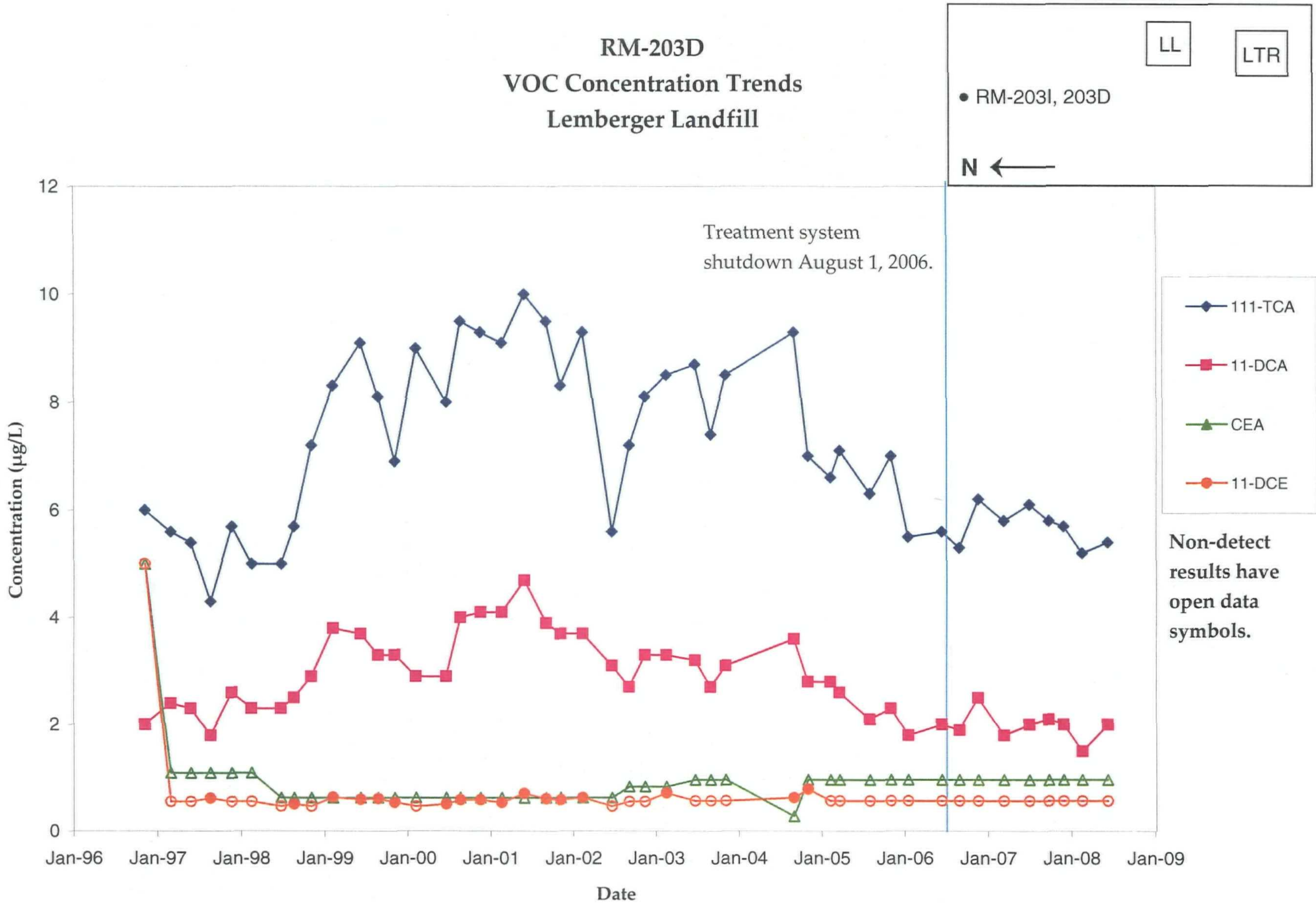
RM-210I
VOC Concentration Trends
Lemberger Landfill



48

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

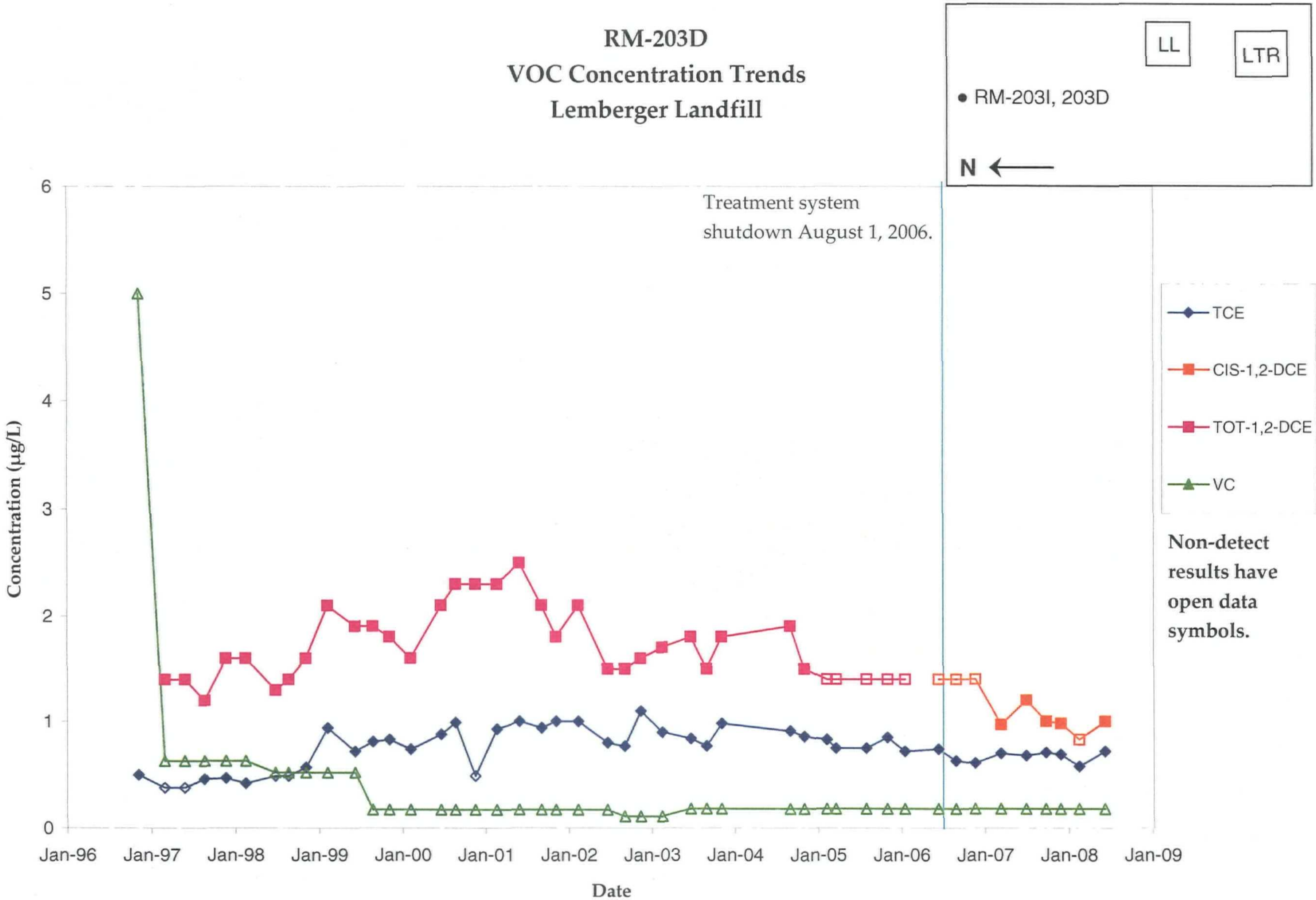
RM-203D
VOC Concentration Trends
Lemberger Landfill



49

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

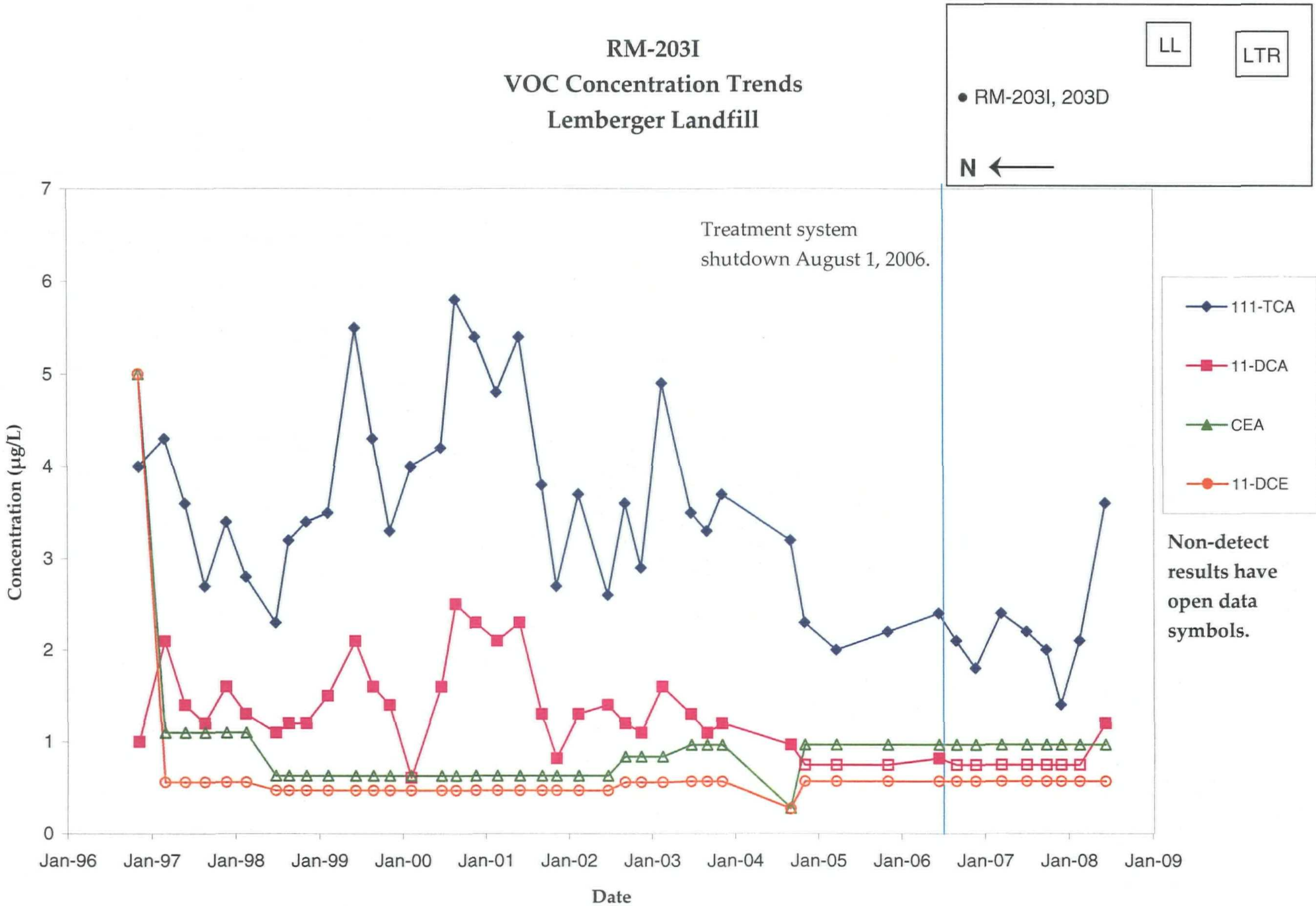
RM-203D
VOC Concentration Trends
Lemberger Landfill



50

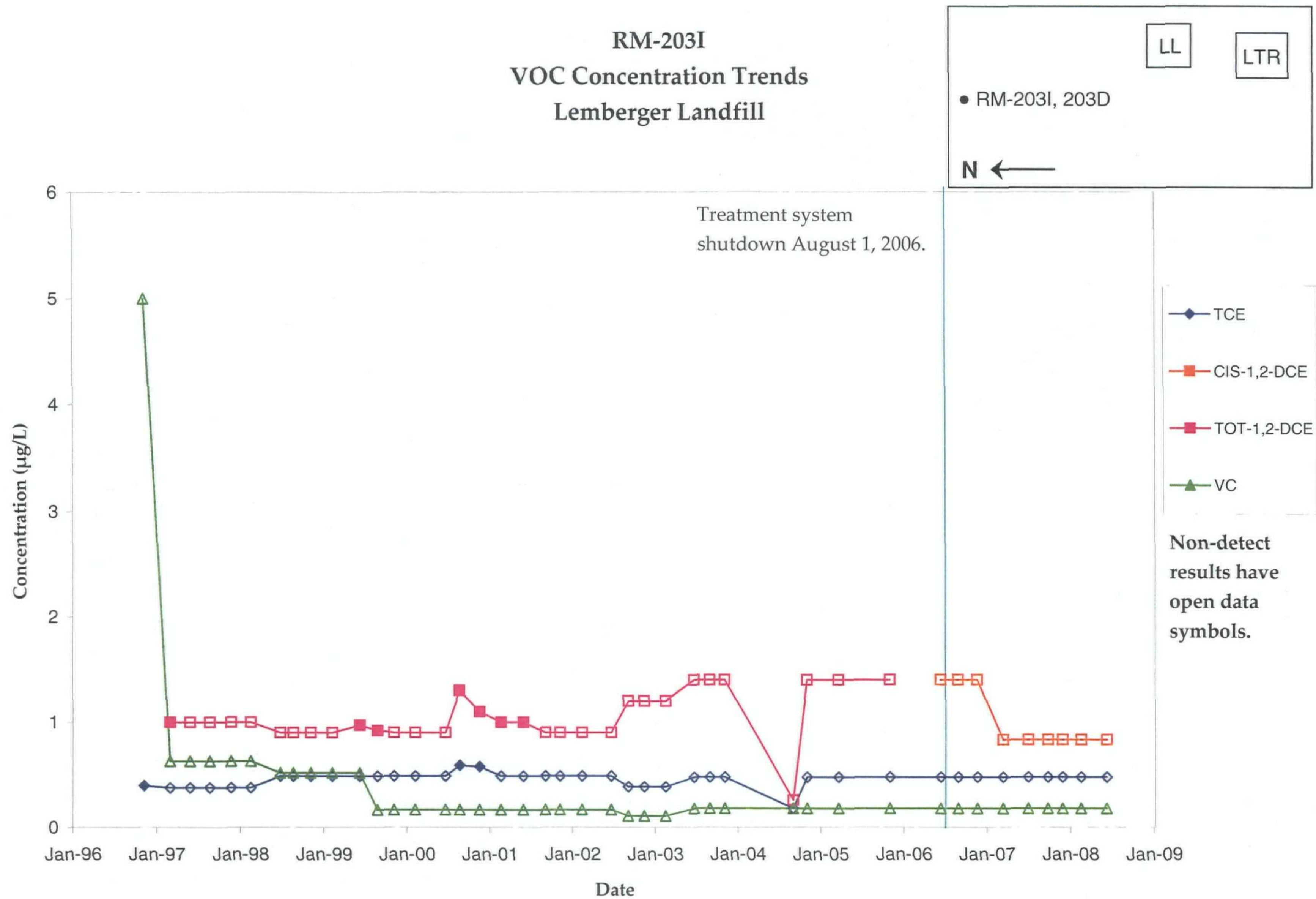
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

RM-203I
VOC Concentration Trends
Lemberger Landfill



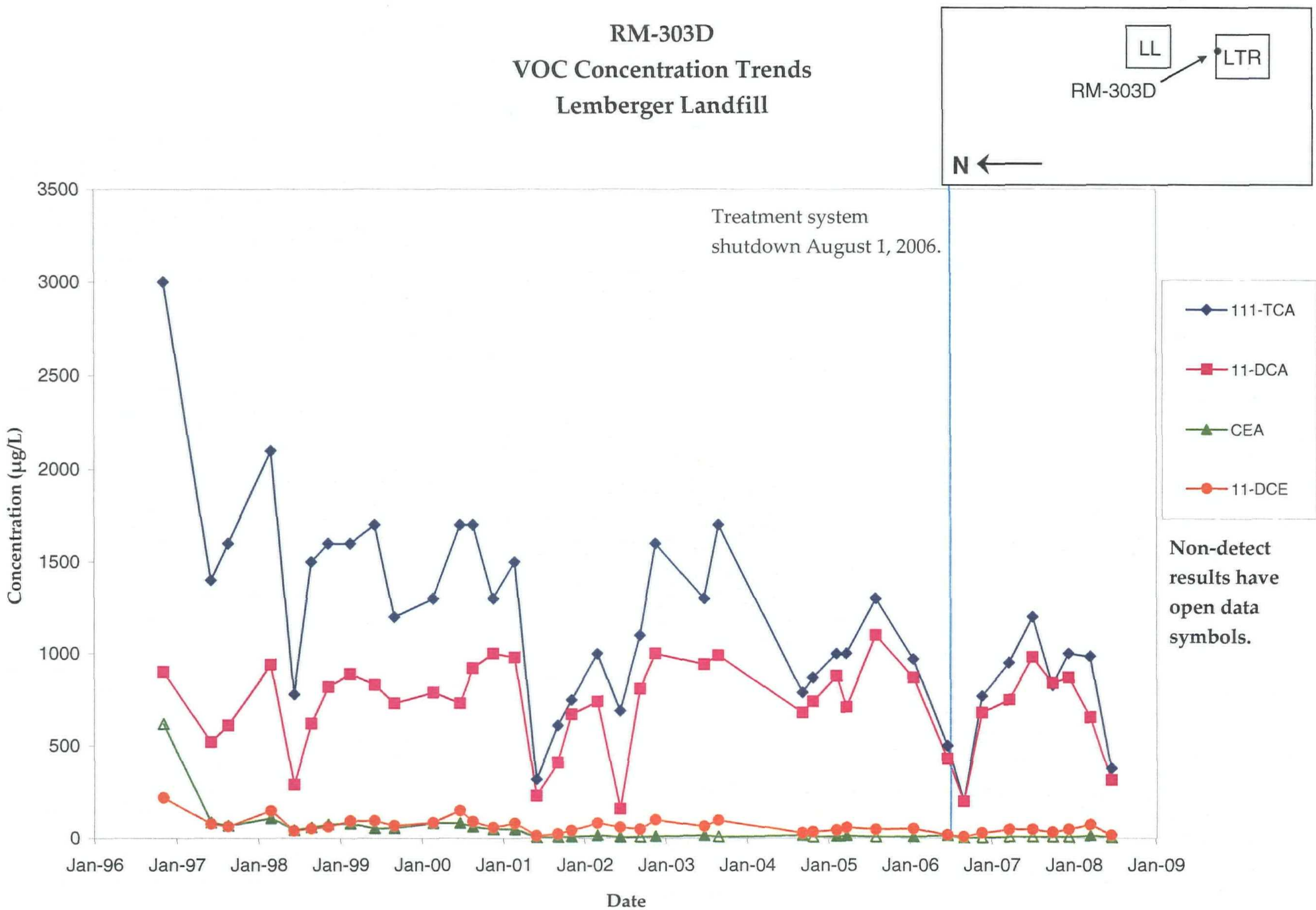
5

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



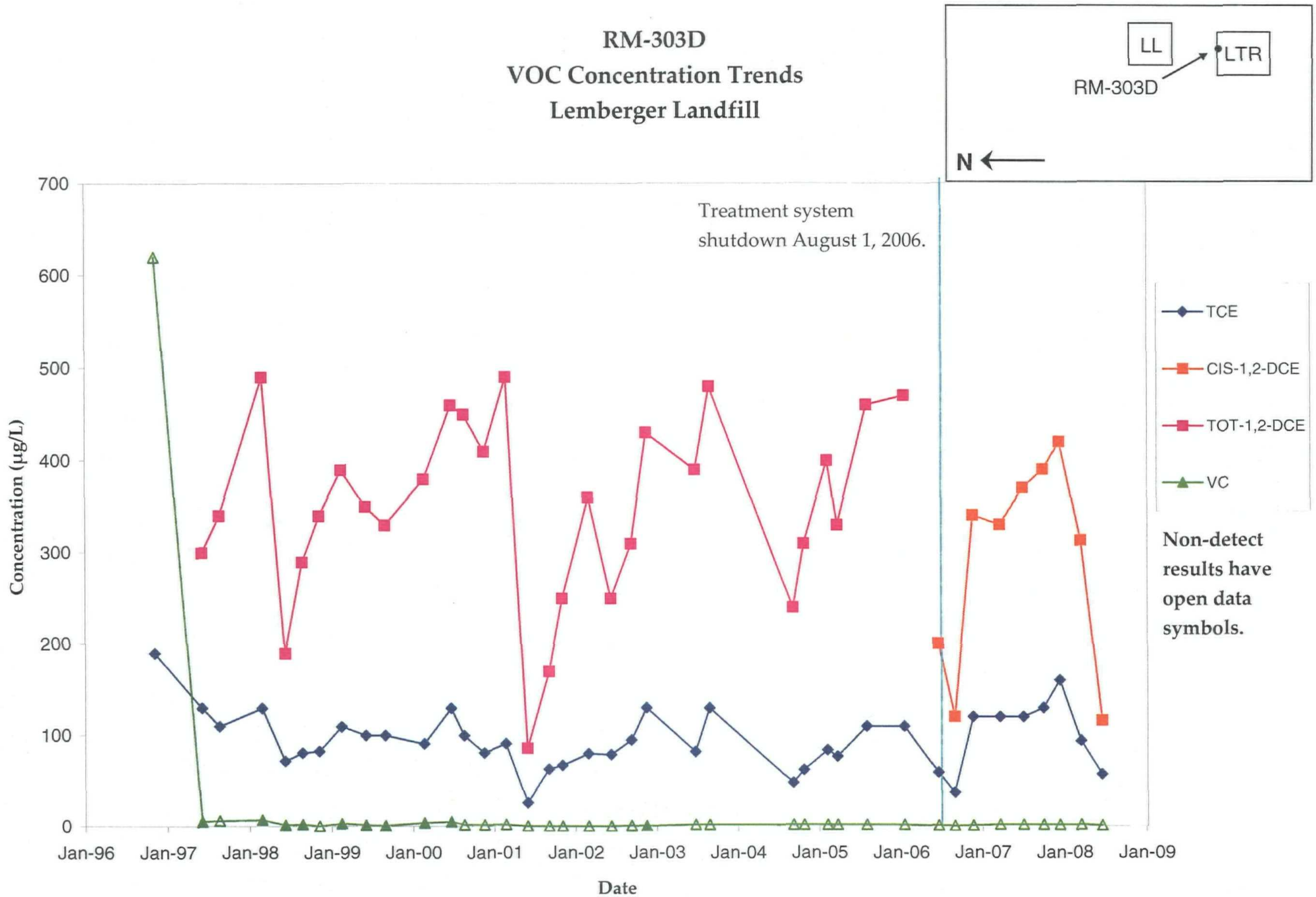
25

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



RM-303D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-303D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
3500
3000
2500
2000
1500
1000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.

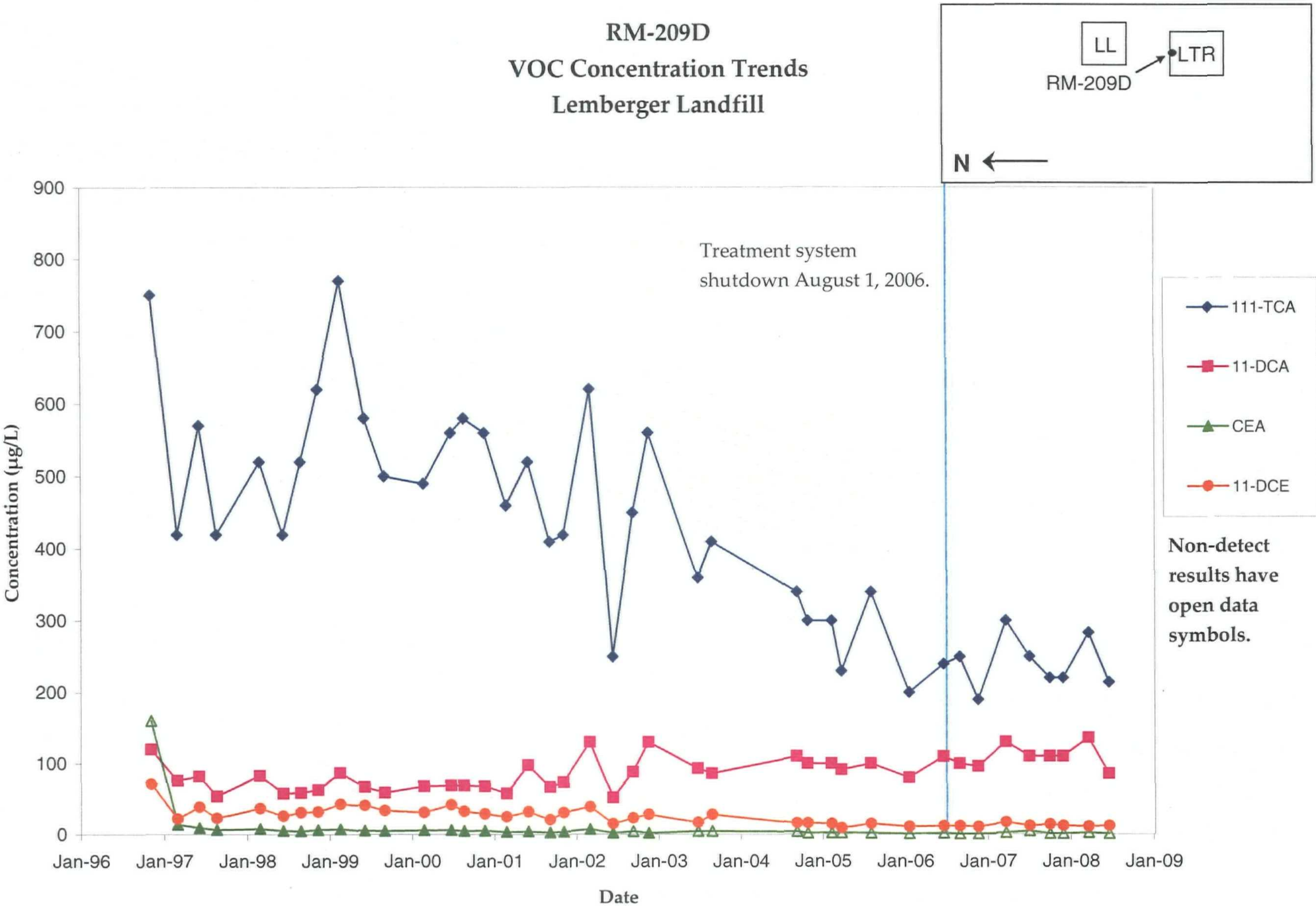
RM-303D
VOC Concentration Trends
Lemberger Landfill



54

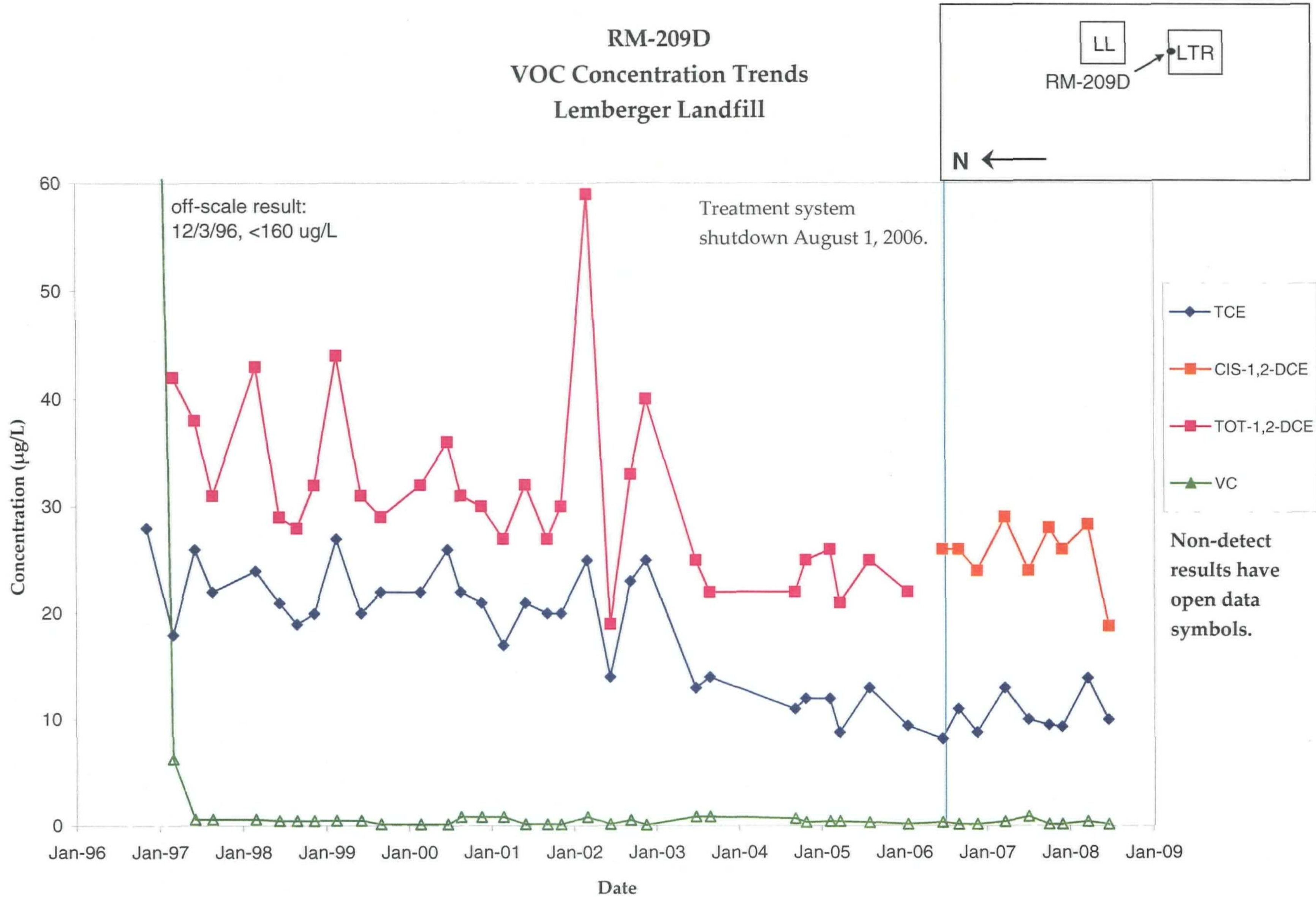
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

RM-209D
VOC Concentration Trends
Lemberger Landfill



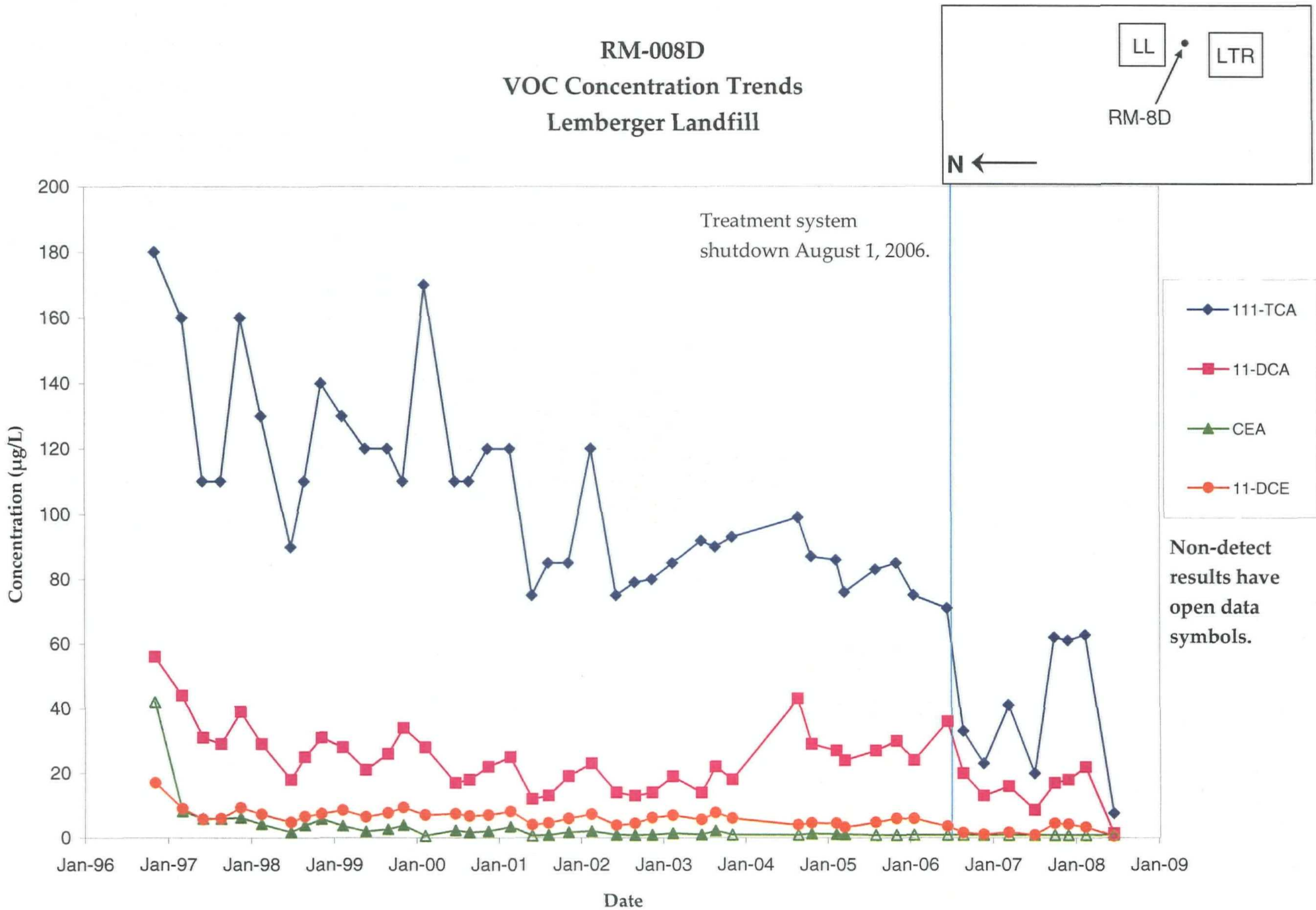
Non-detect results have open data symbols.

55



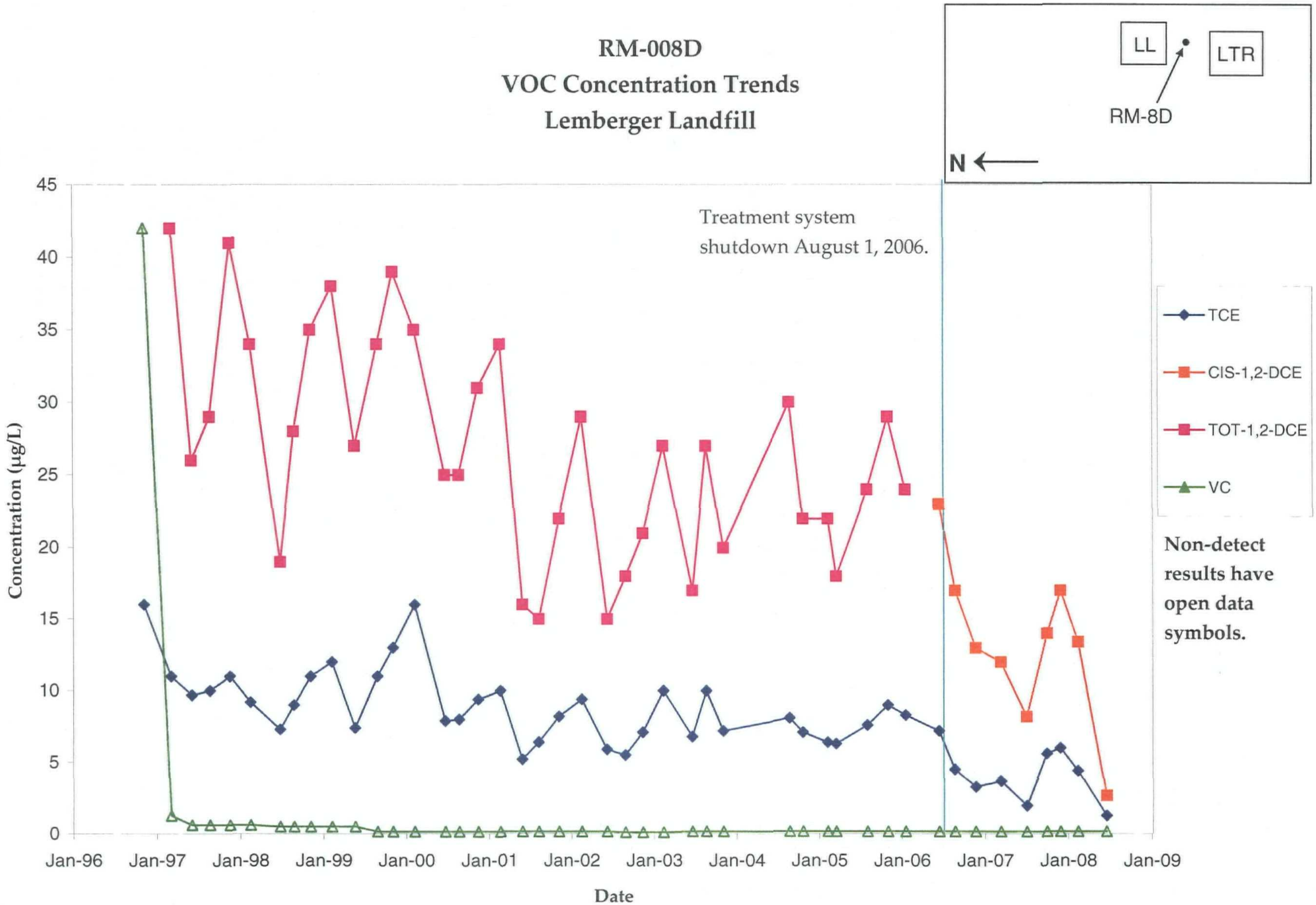
56

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

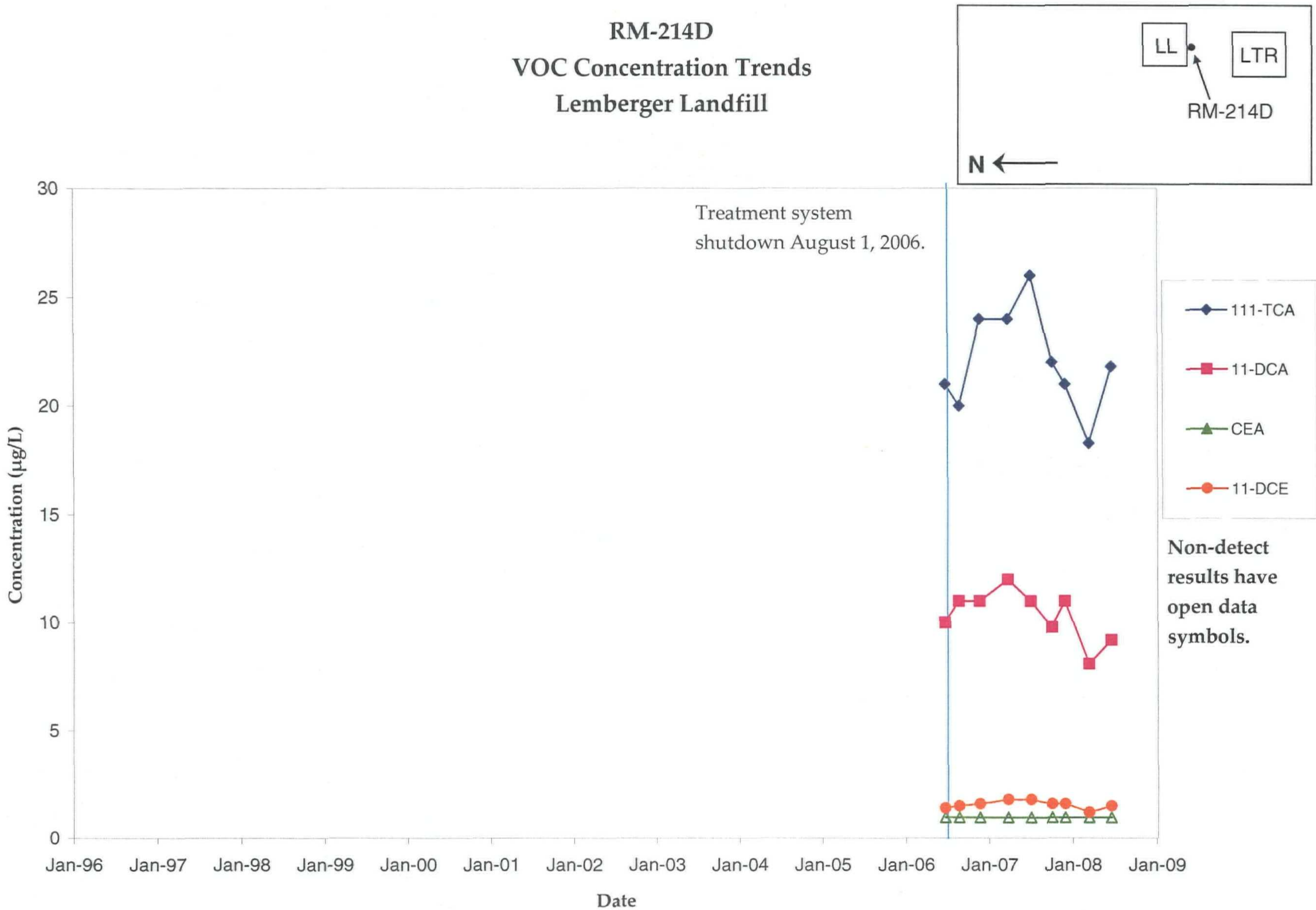


LS

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



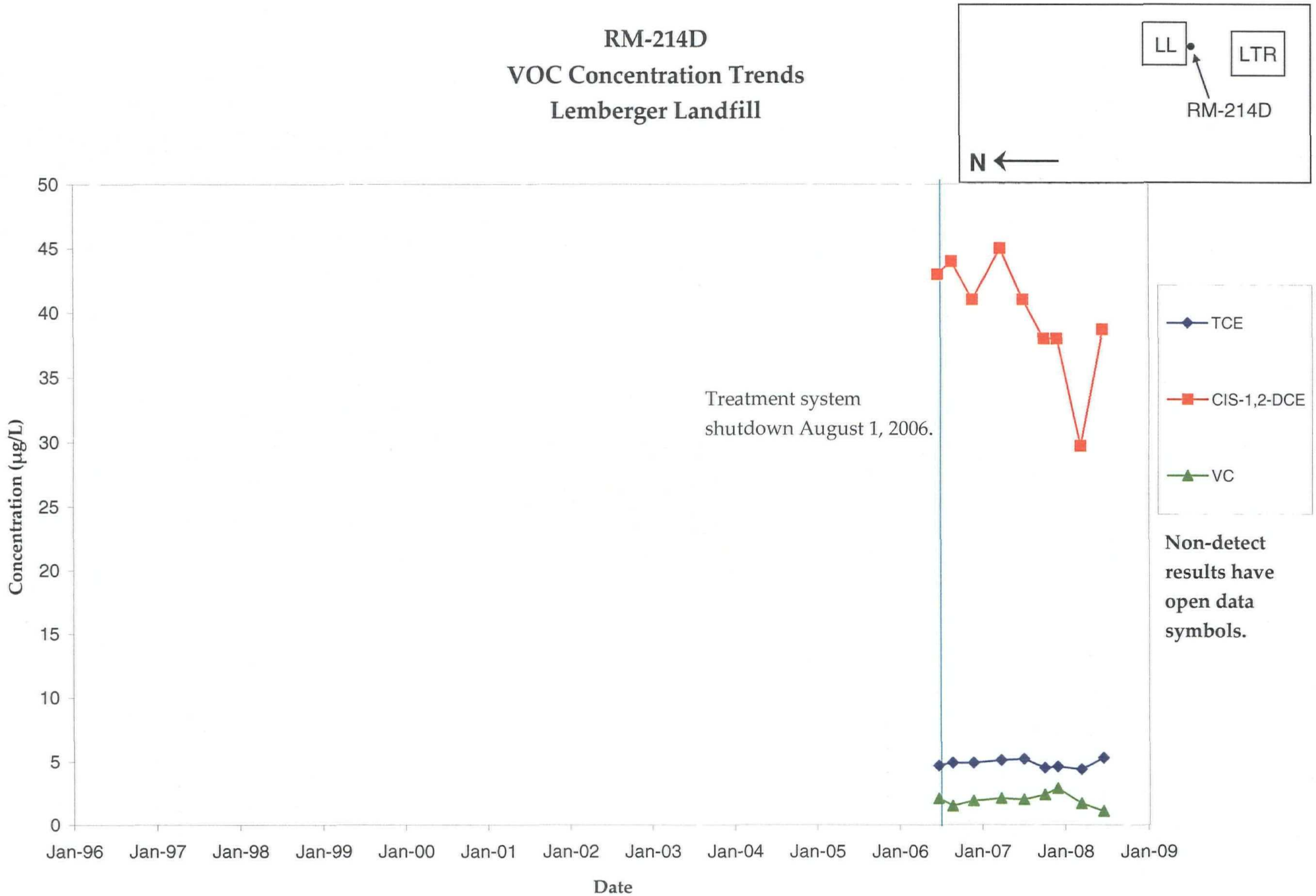
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

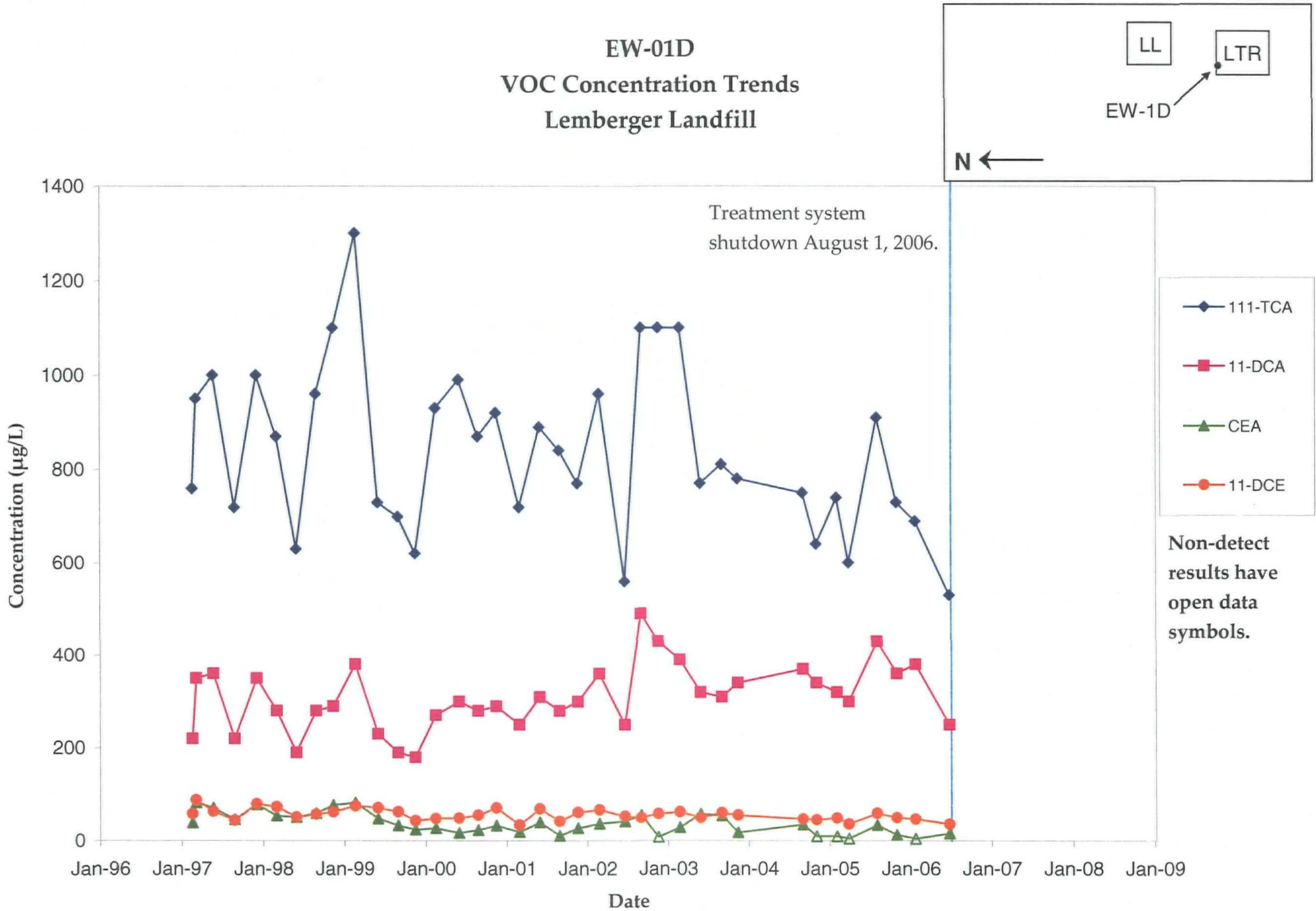


69

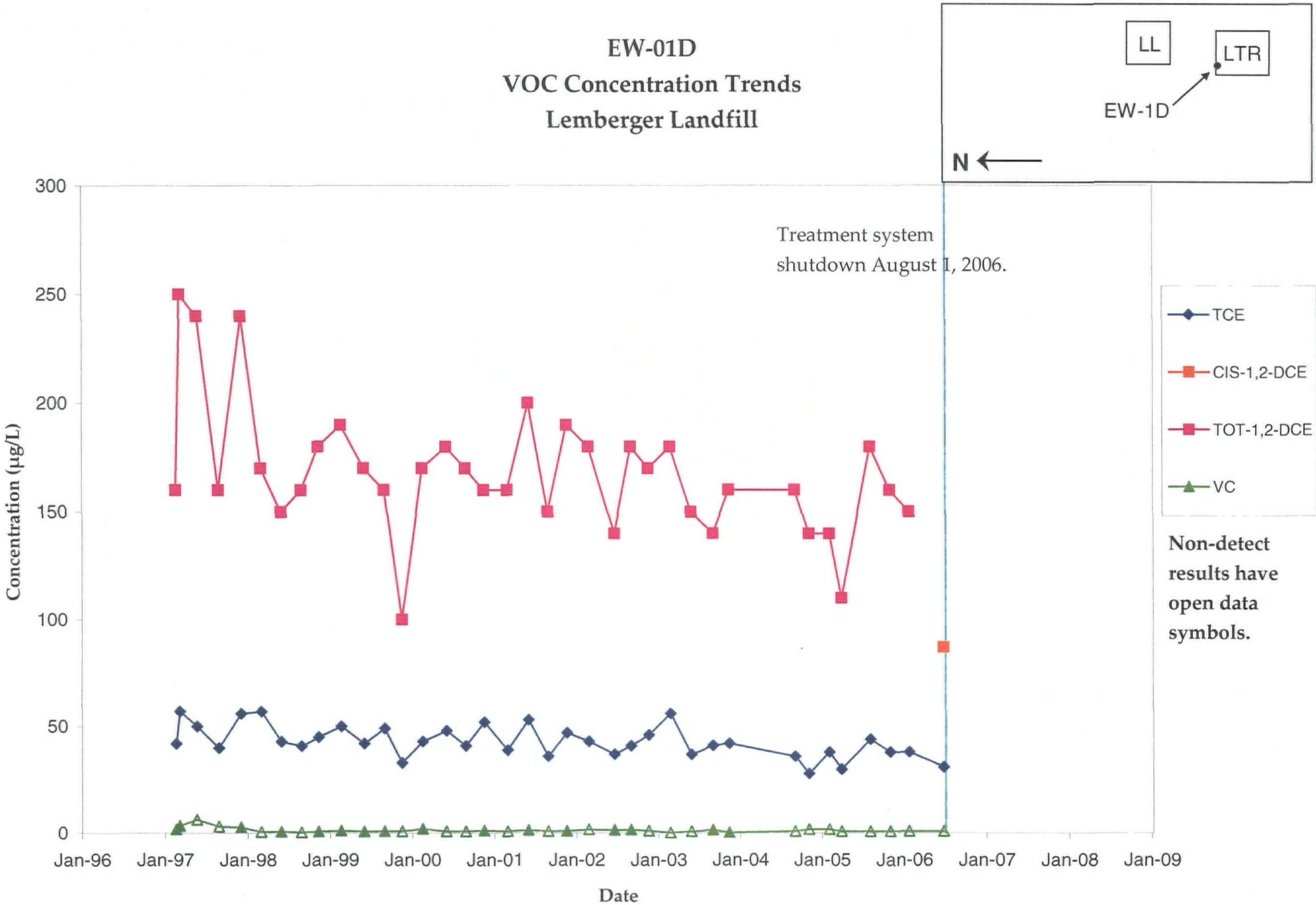
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

RM-214D
VOC Concentration Trends
Lemberger Landfill

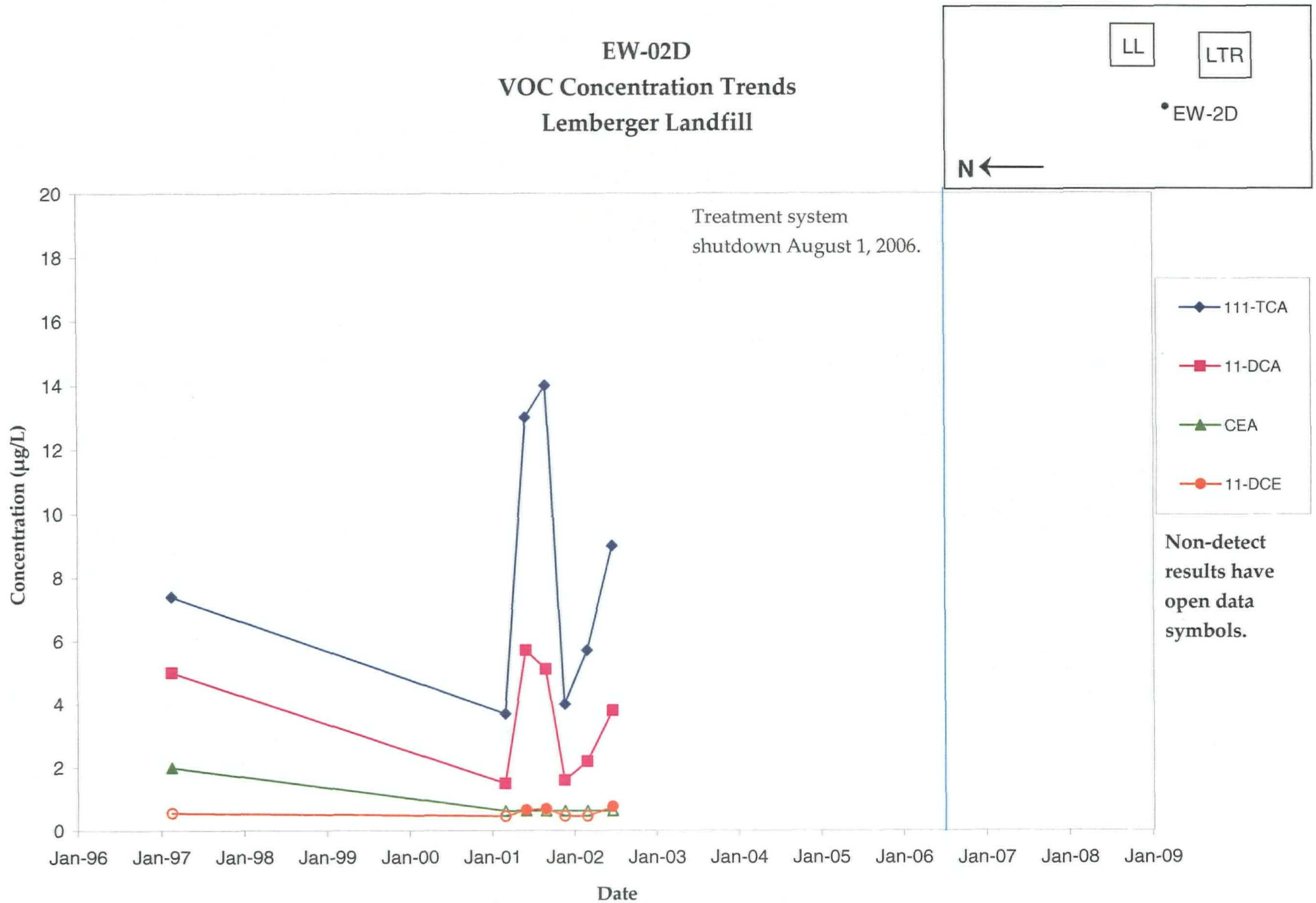




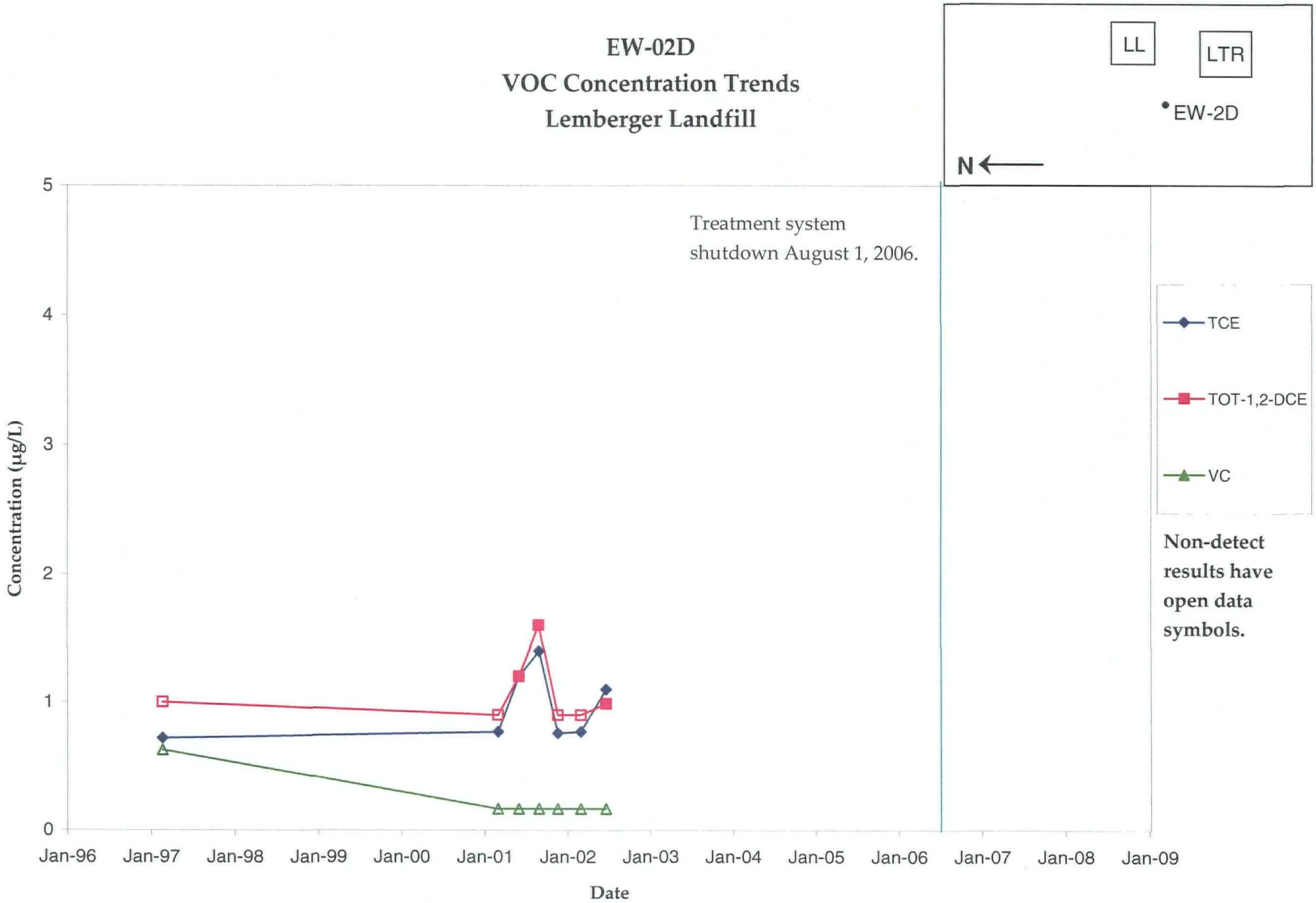
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

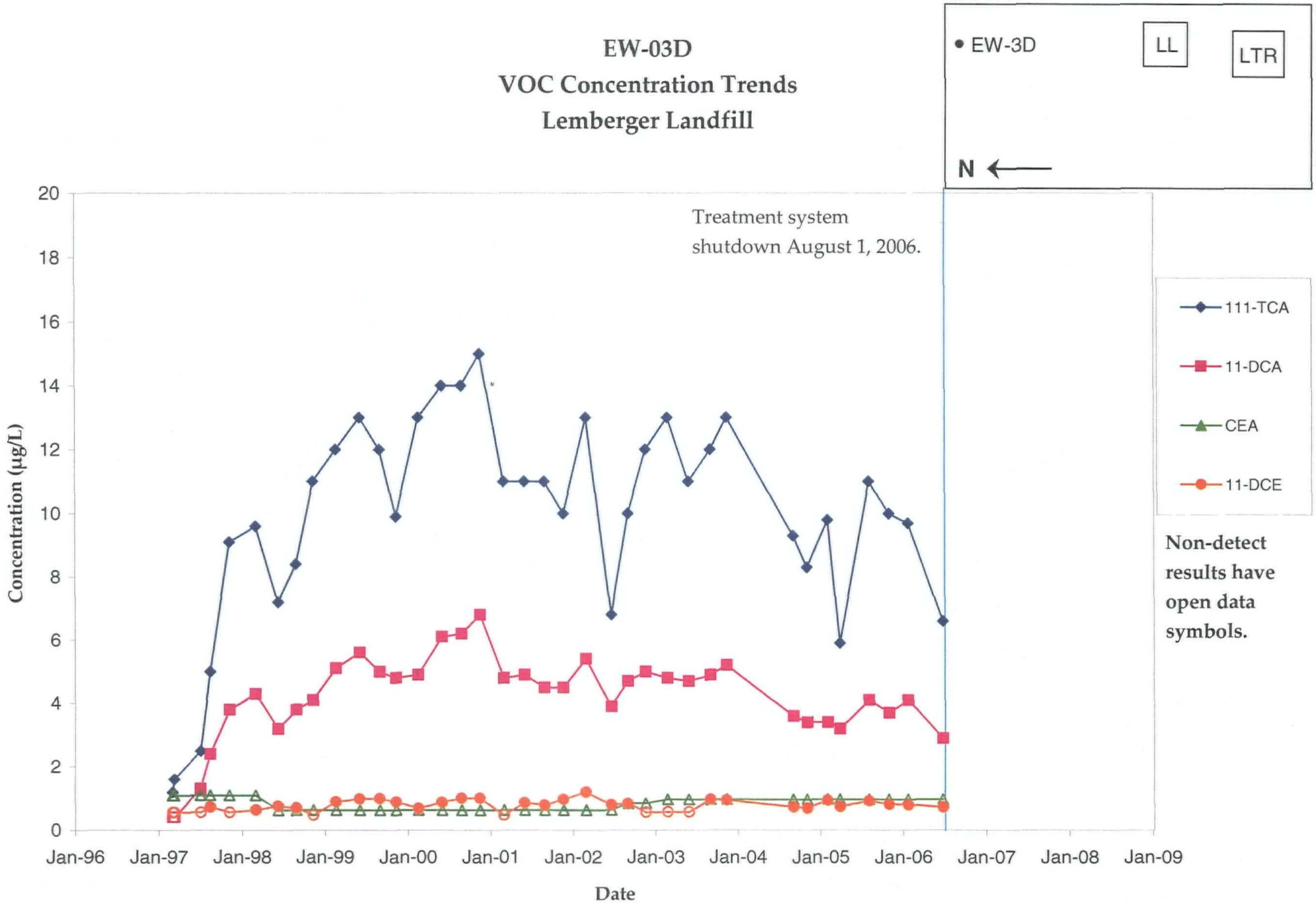

EW-02D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
EW-2D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
0
2
4
6
8
10
12
14
16
18
20
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.

63



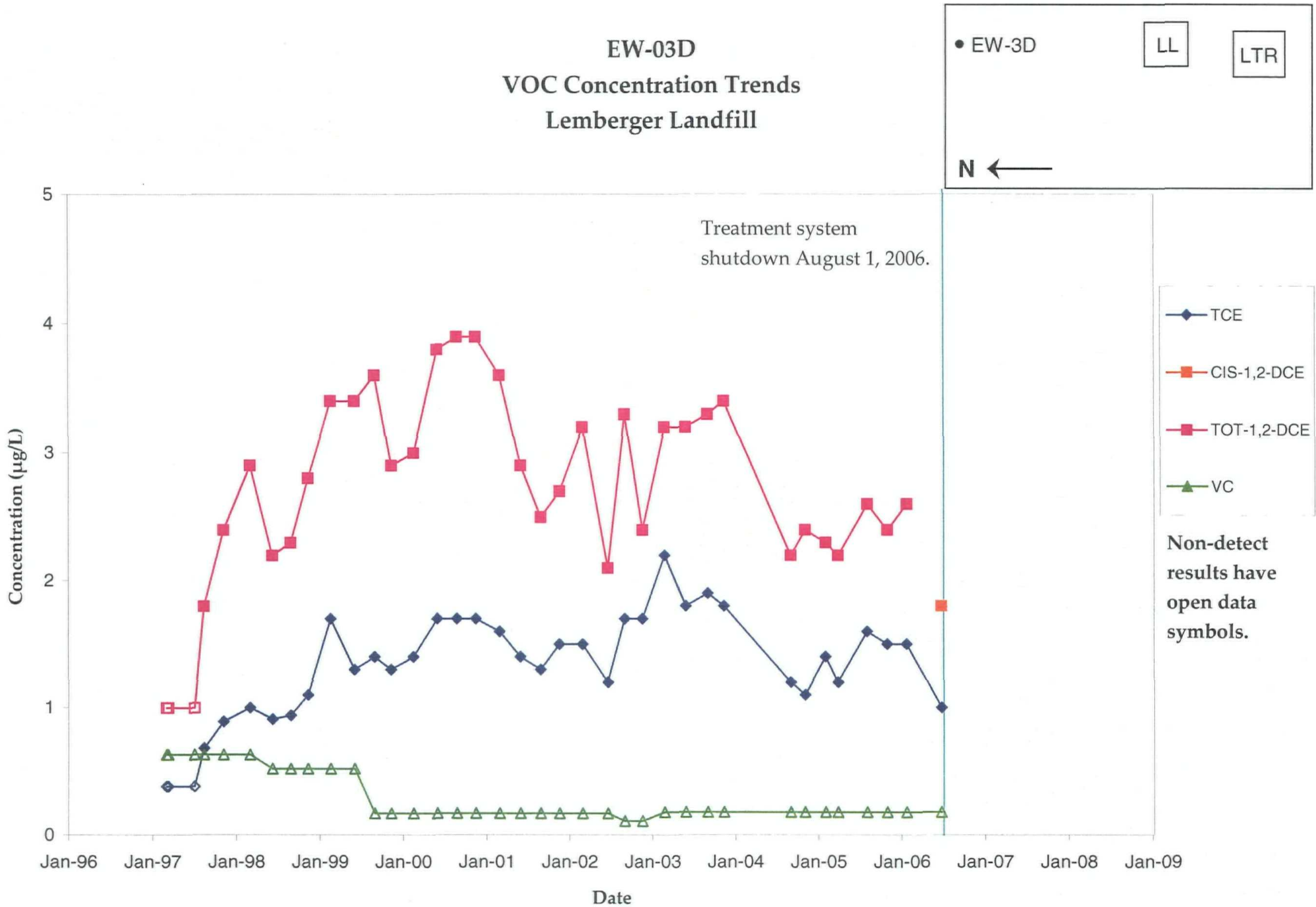
64

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



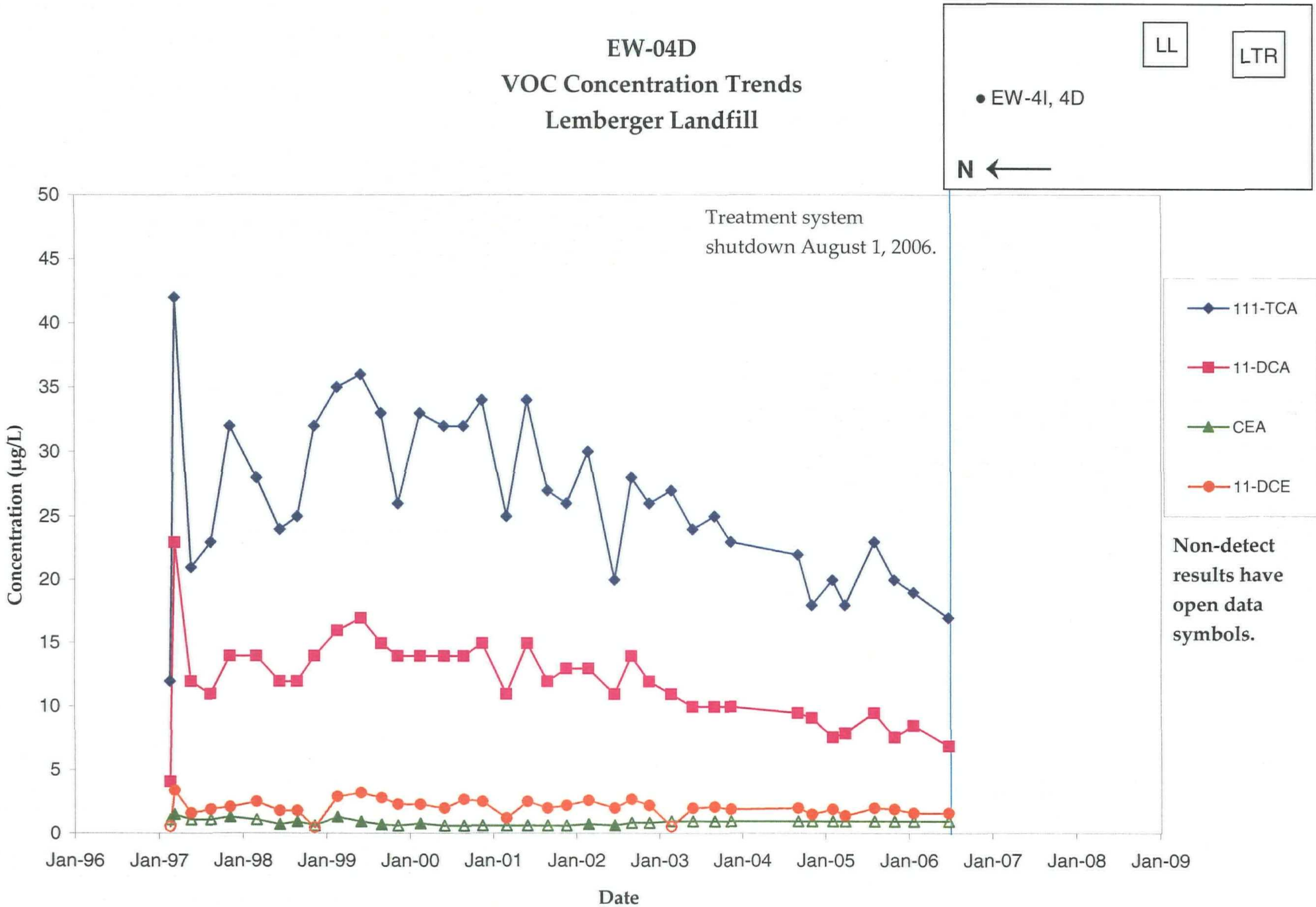
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

65



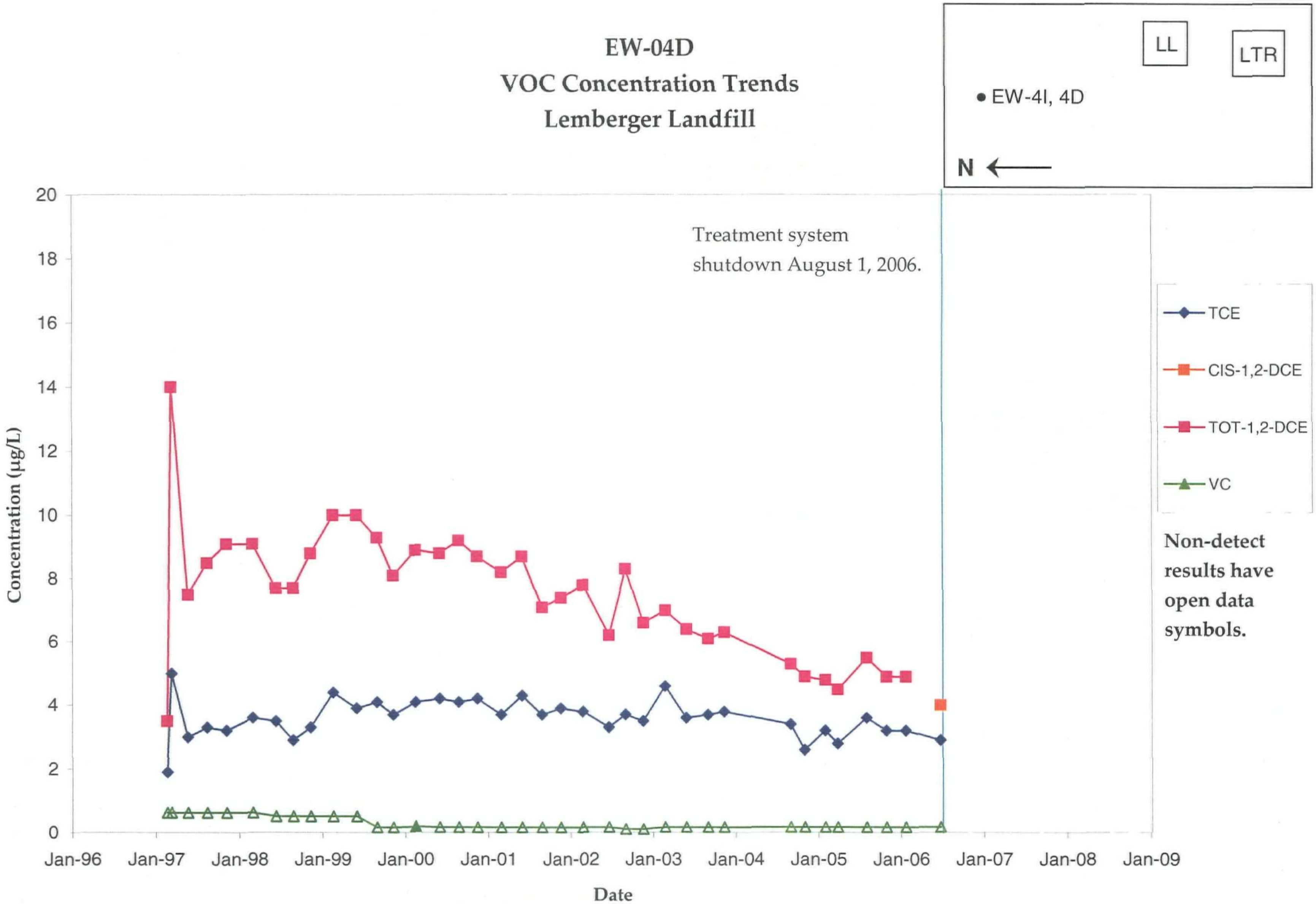
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

EW-04D
VOC Concentration Trends
Lemberger Landfill



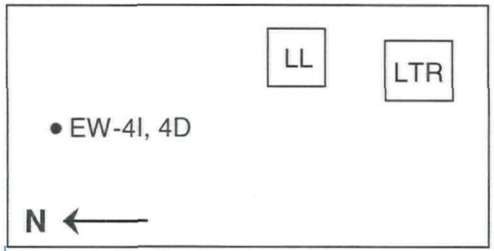
67

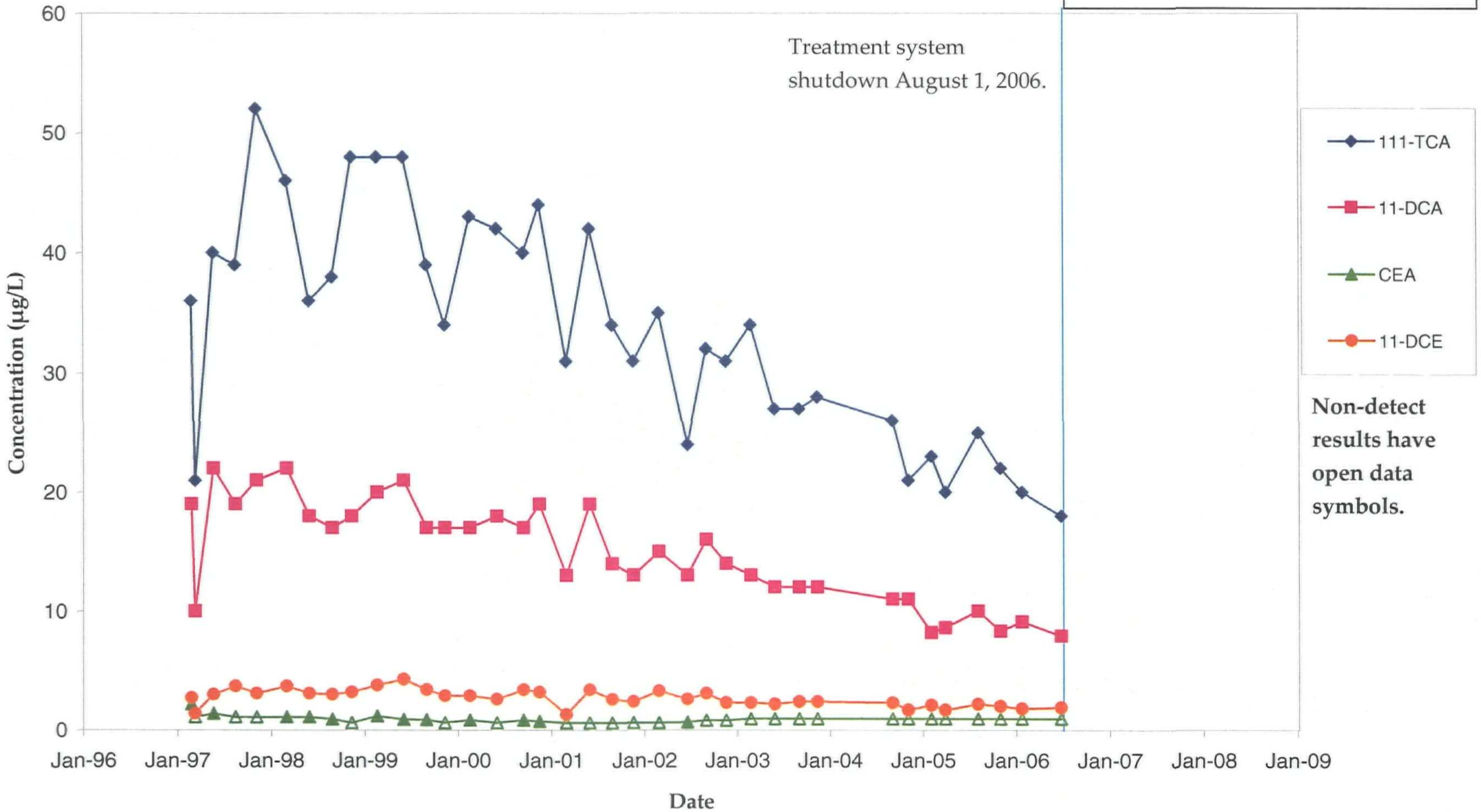
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

EW-04I
VOC Concentration Trends
Lemberger Landfill

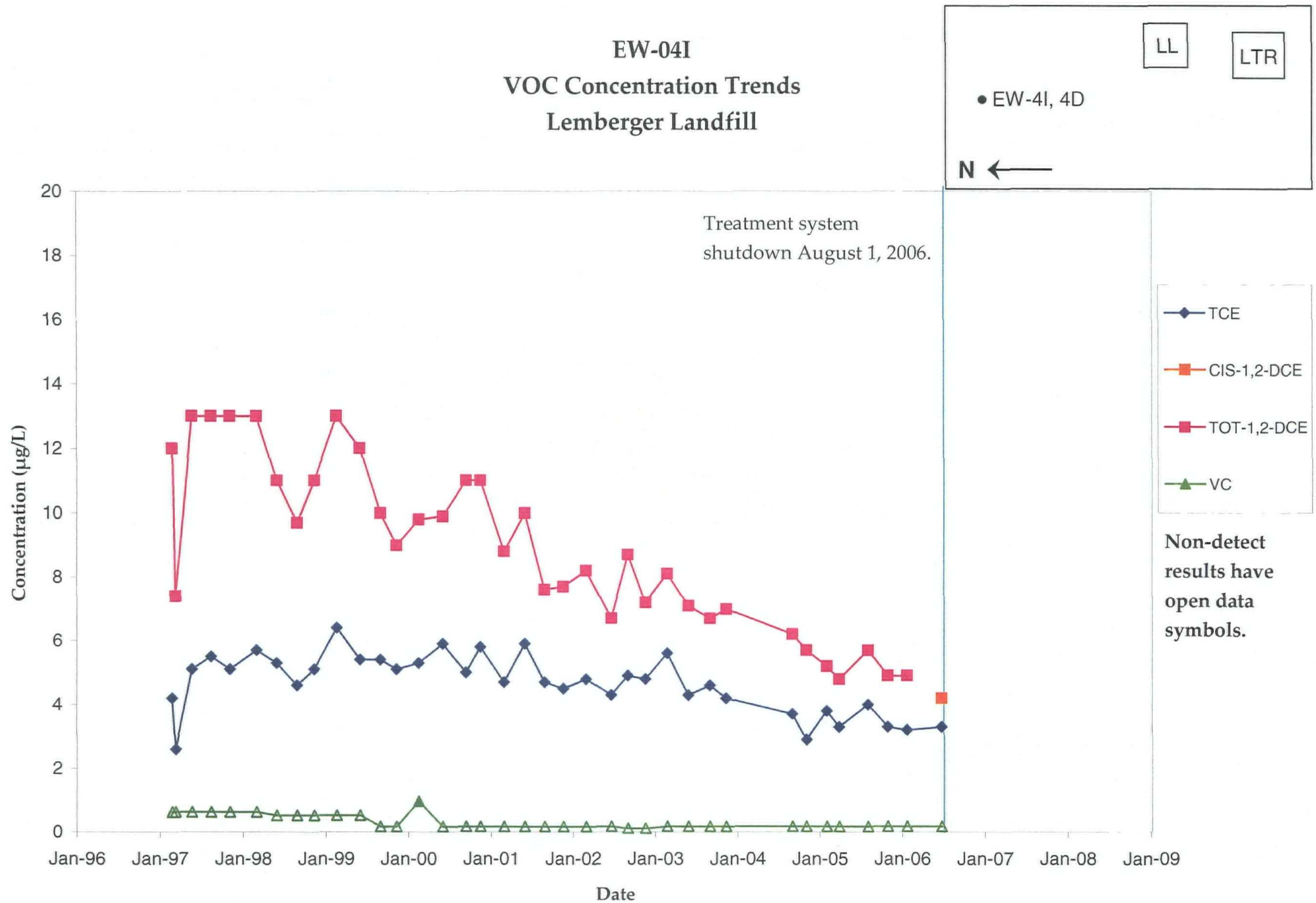




Non-detect results have open data symbols.

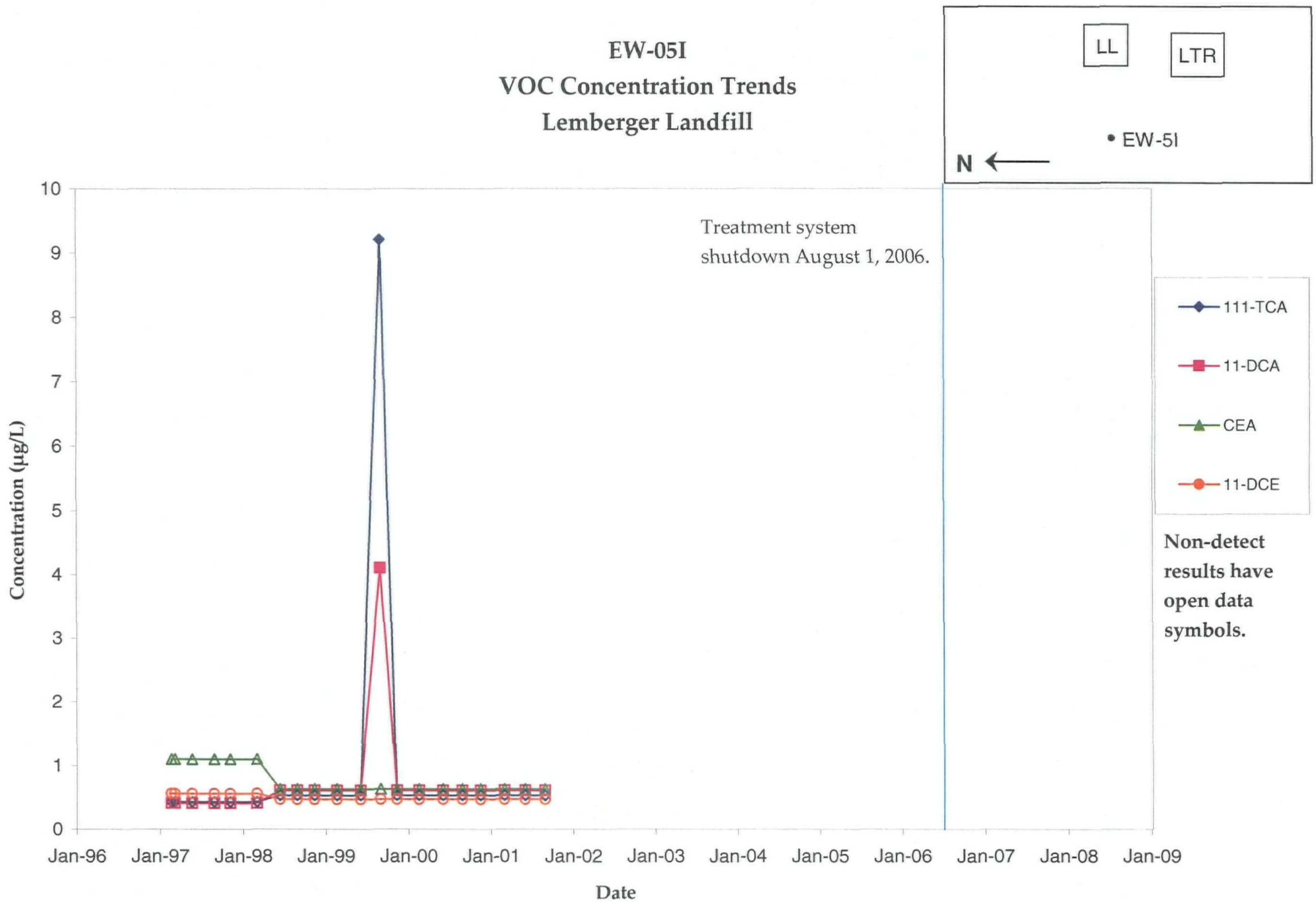
69

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



96

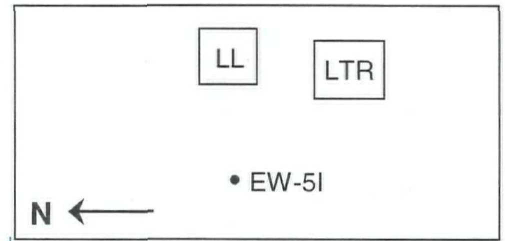
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

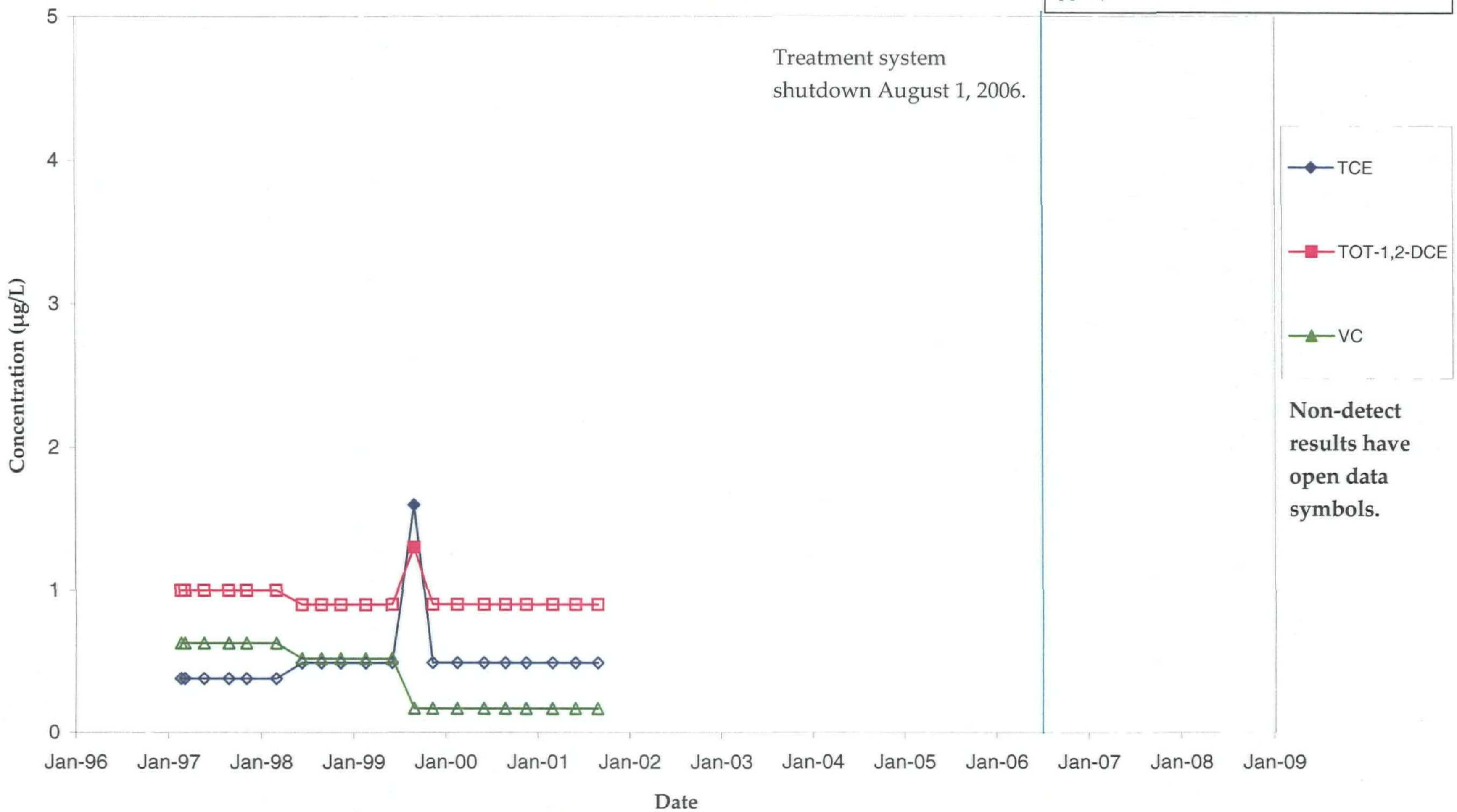


IL

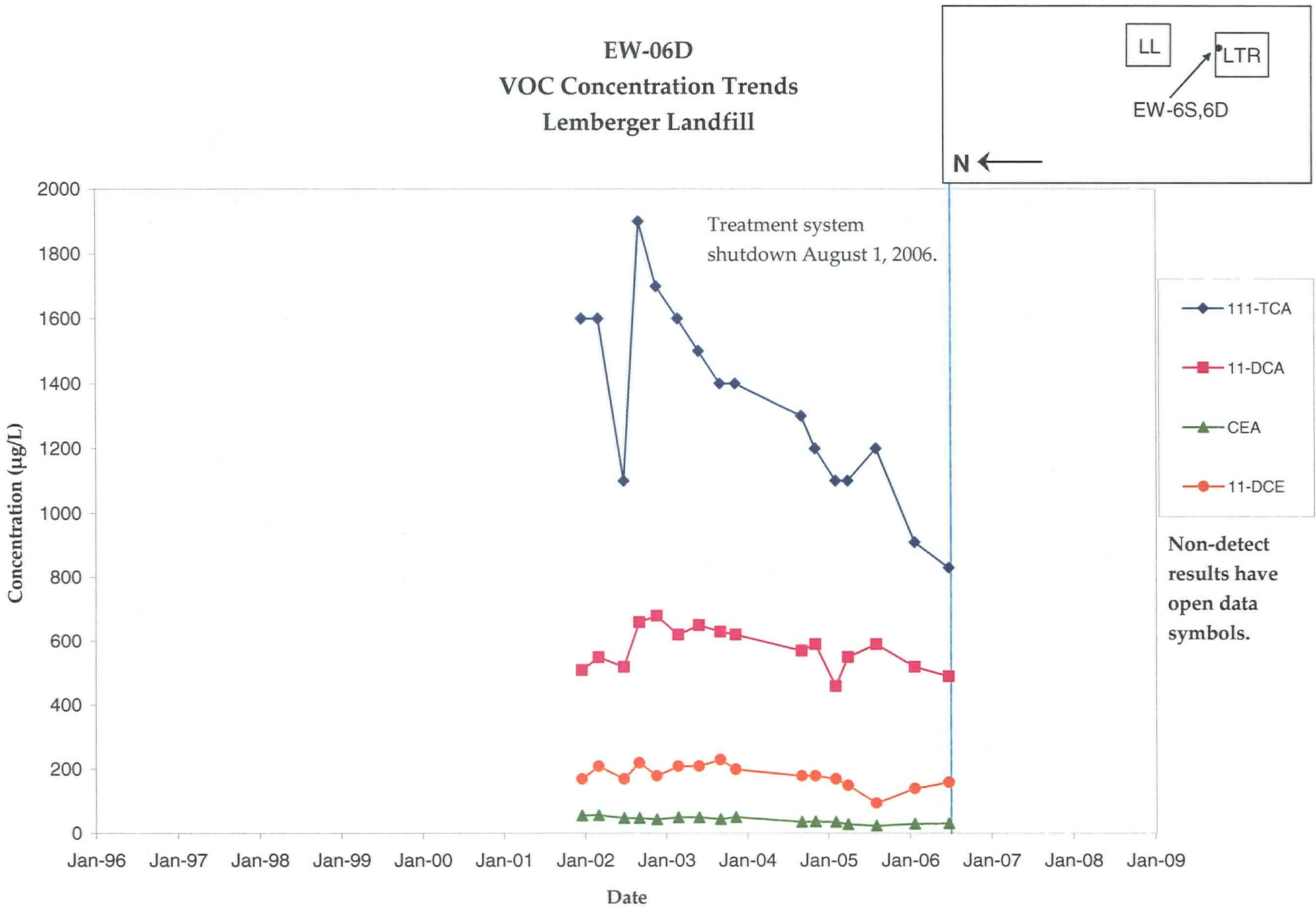
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

EW-05I
VOC Concentration Trends
Lemberger Landfill

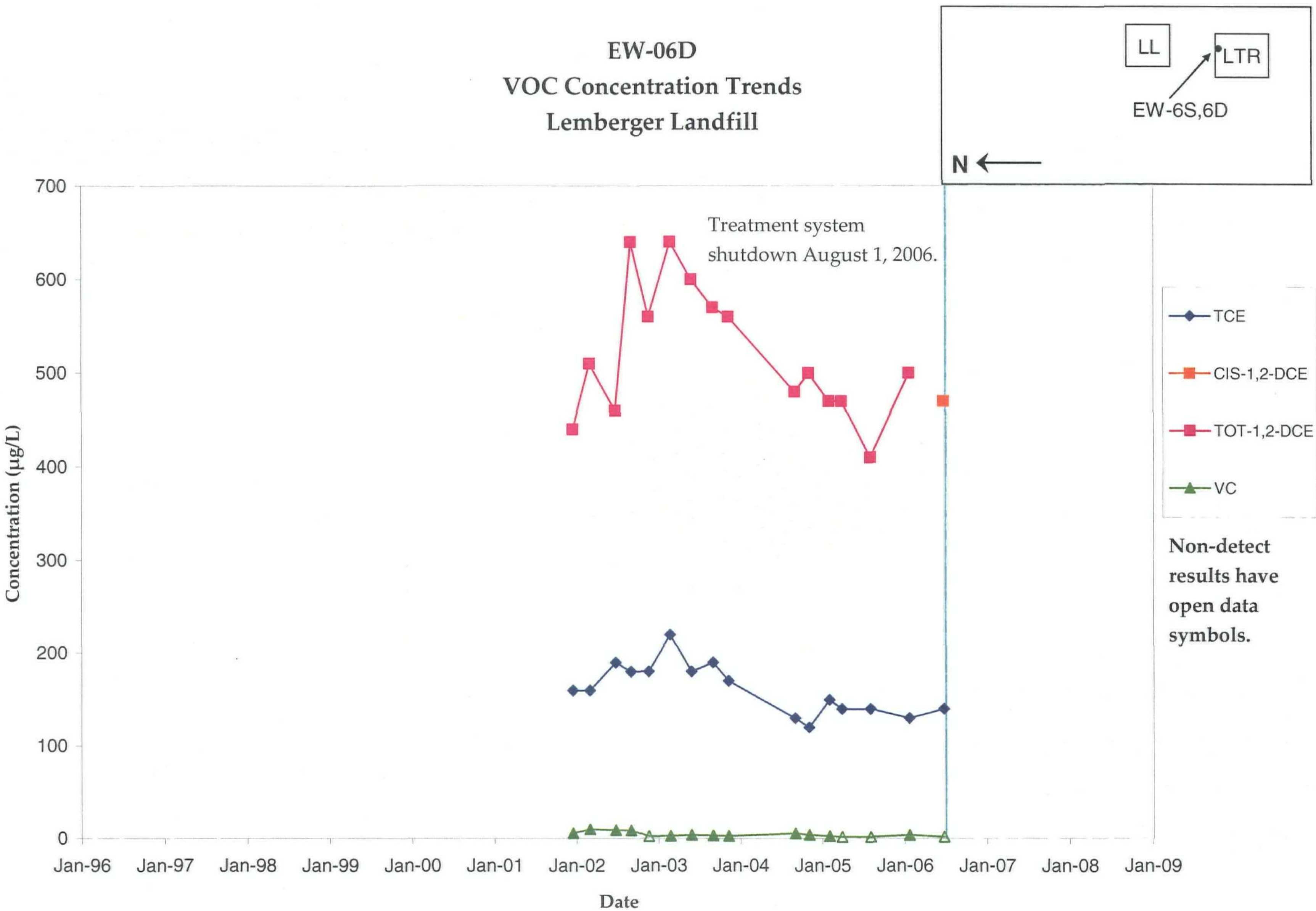




I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

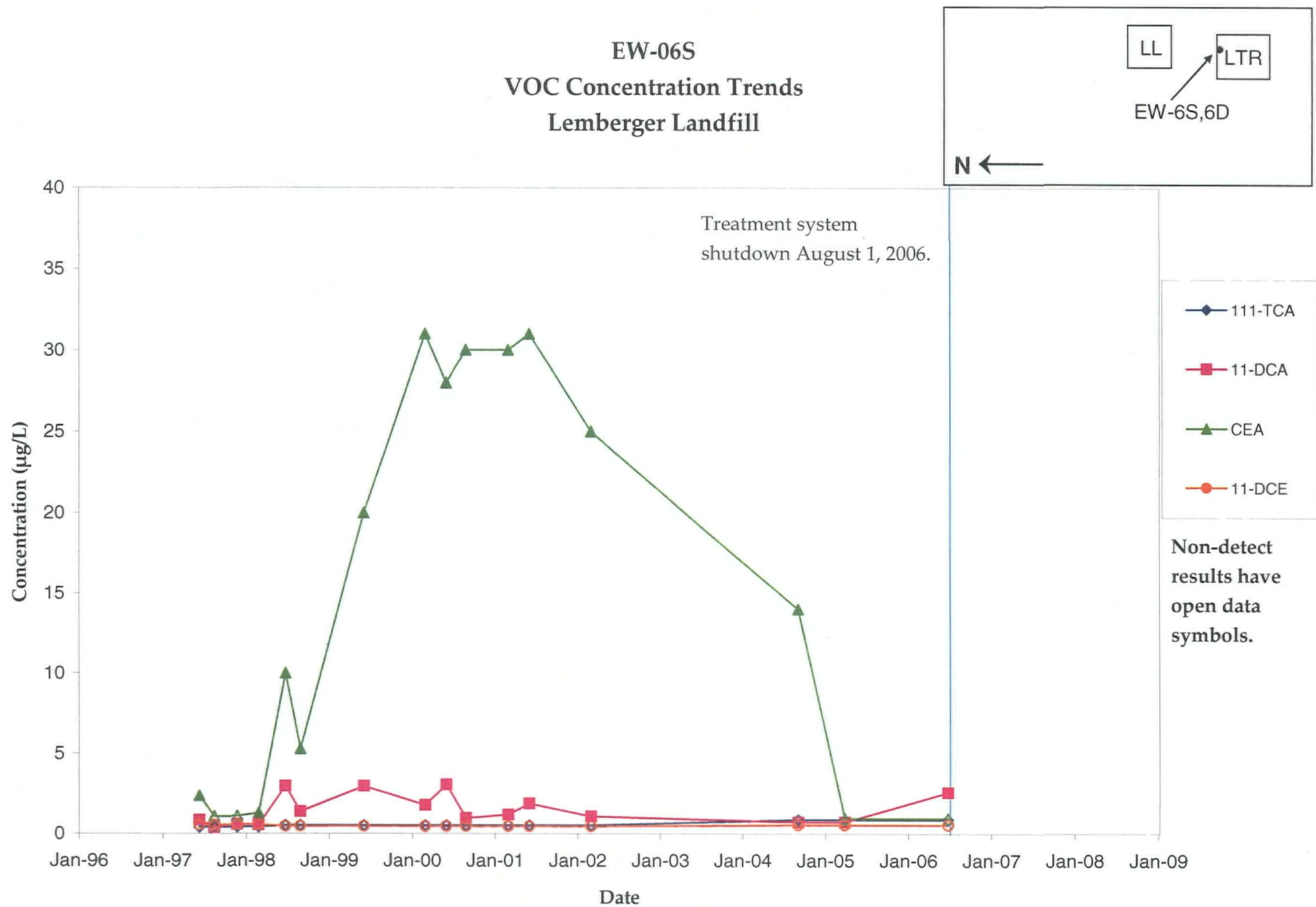

EW-06D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
EW-6S,6D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.

73



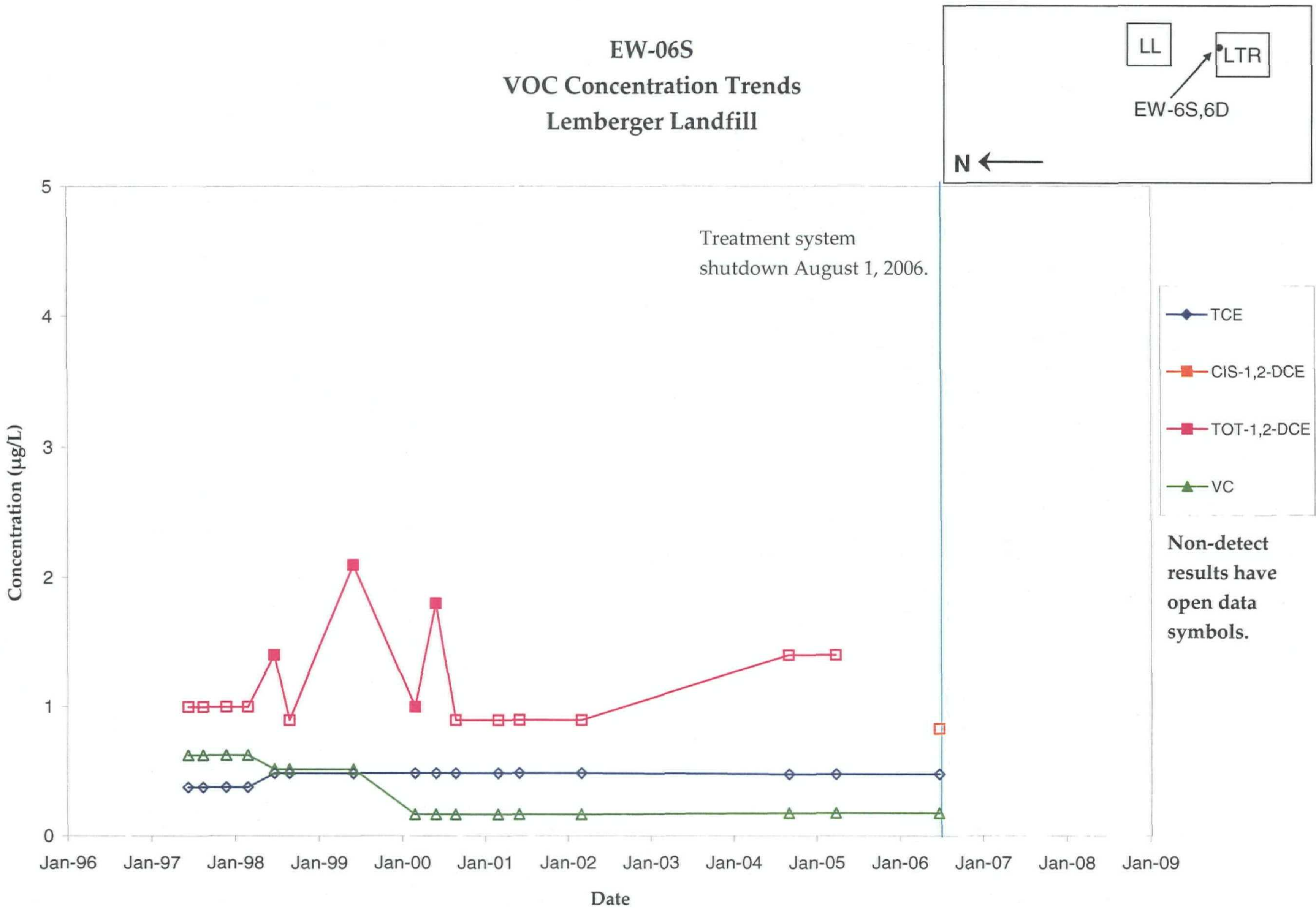
hL

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



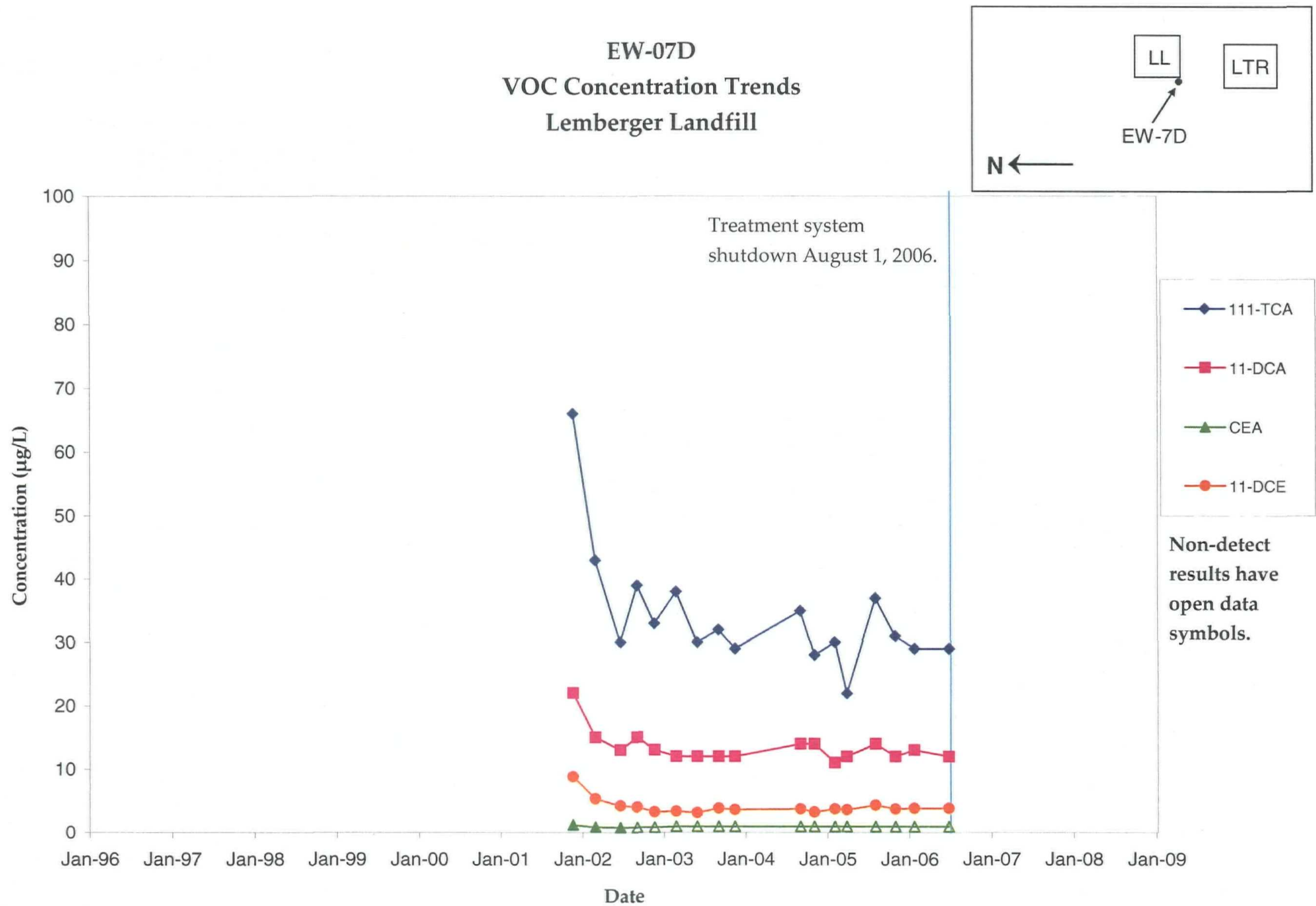
5C

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

[redacted]



LL

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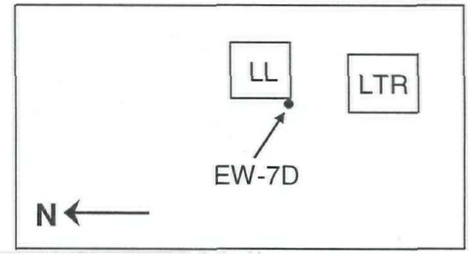
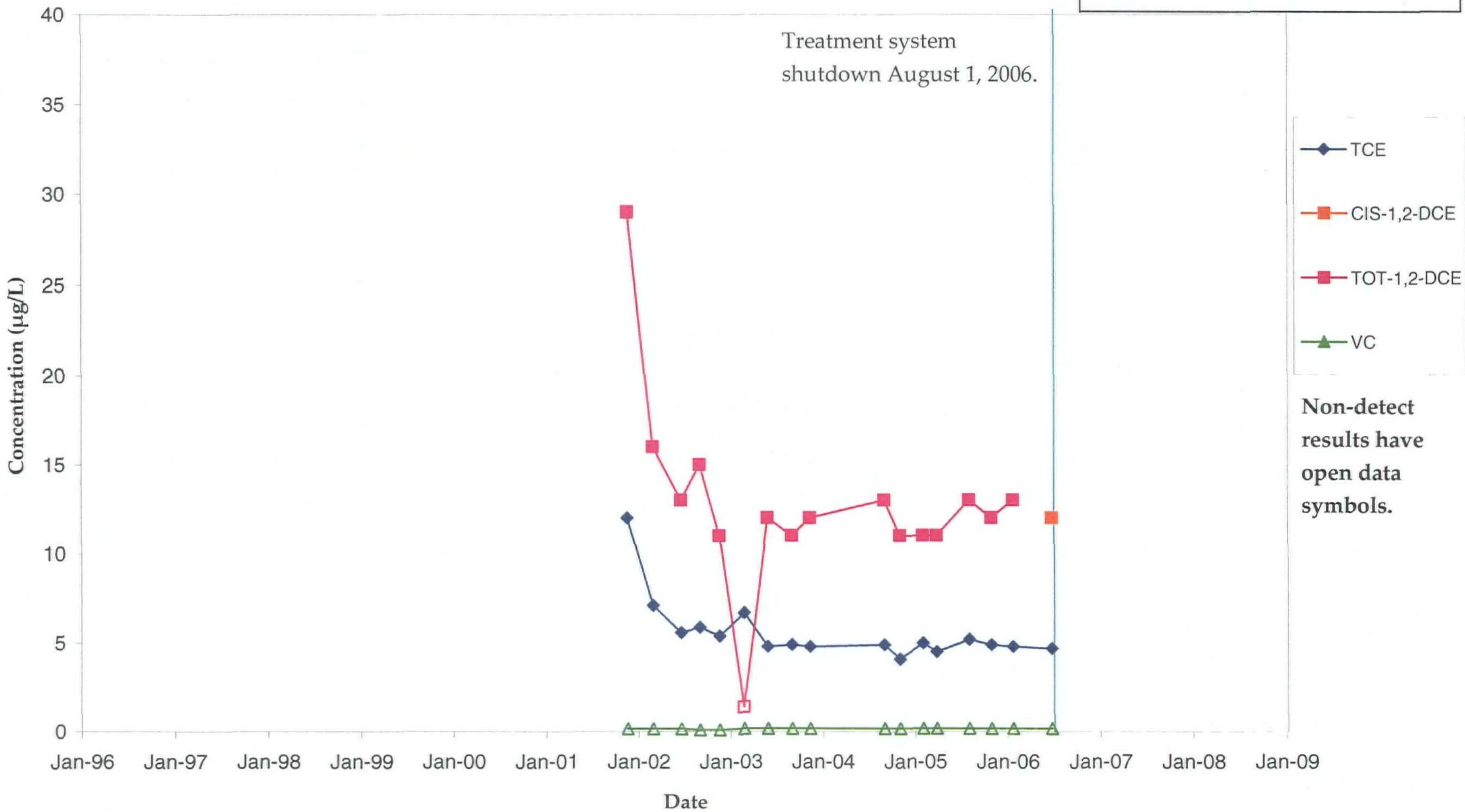
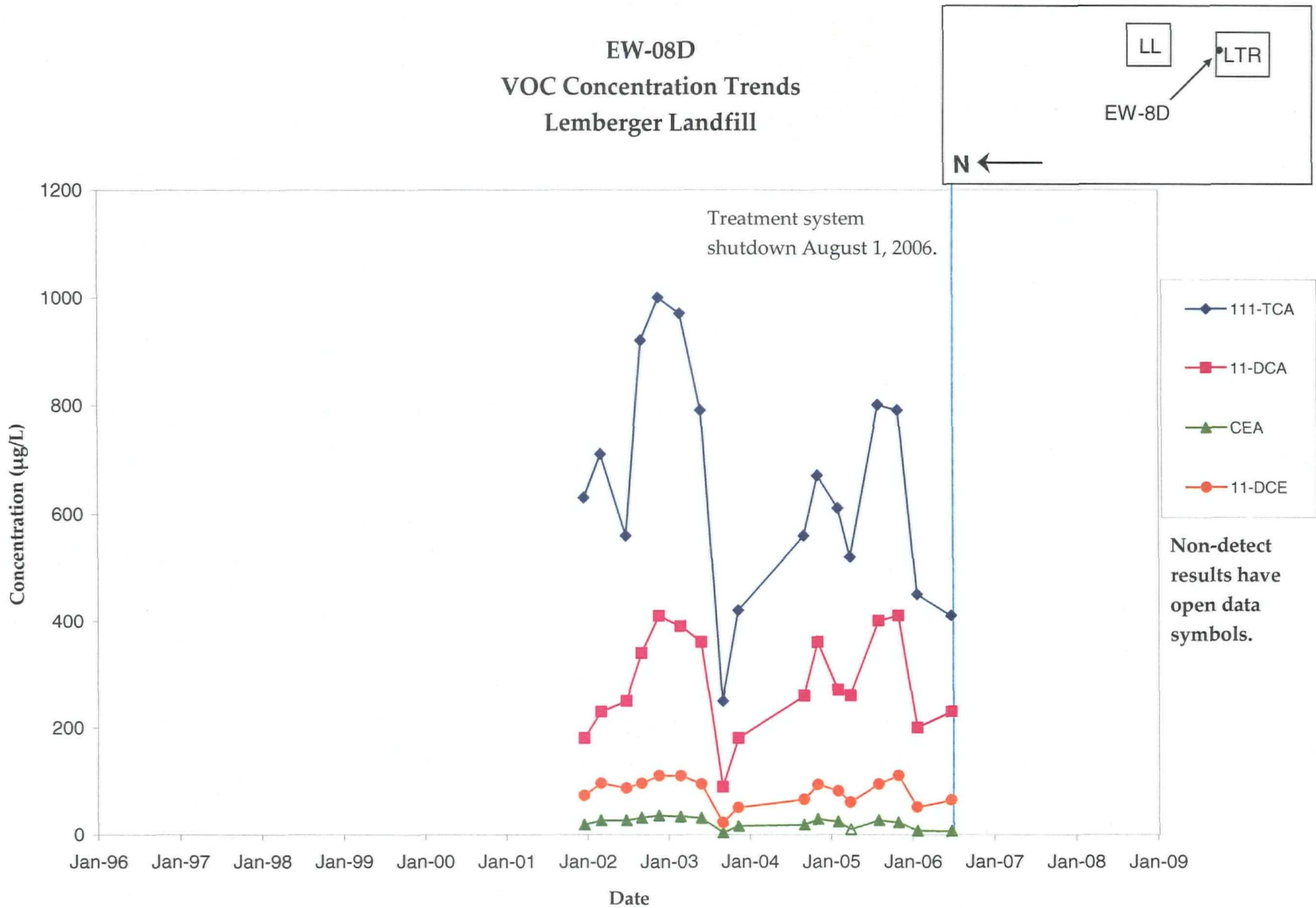
EW-07D
VOC Concentration Trends
Lemberger Landfill





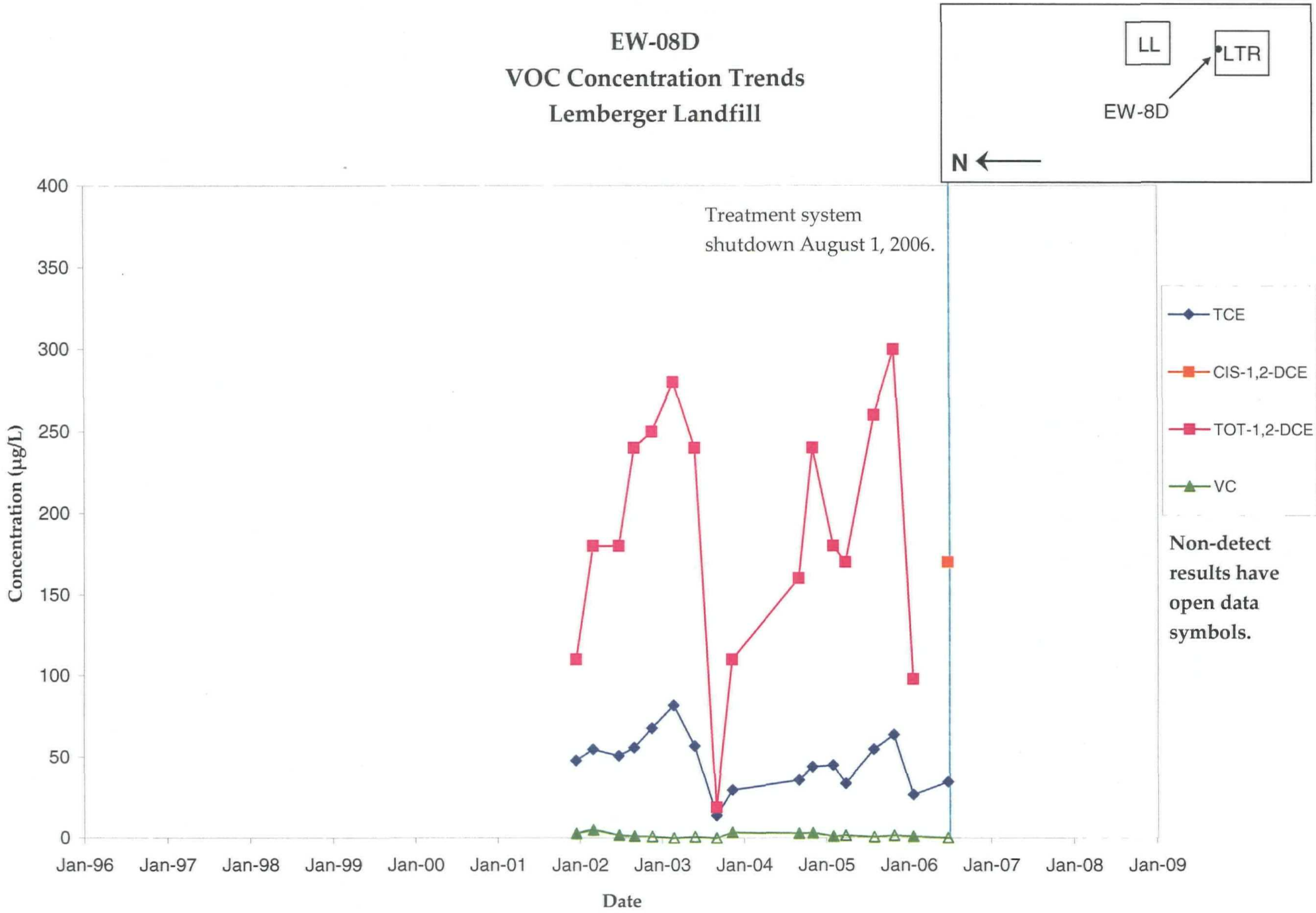
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



79

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

EW-08D
VOC Concentration Trends
Lemberger Landfill

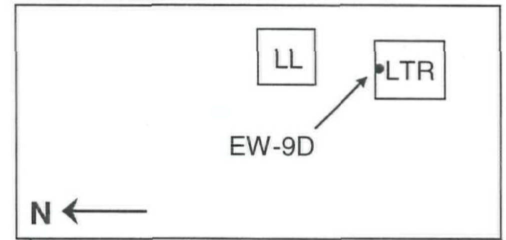


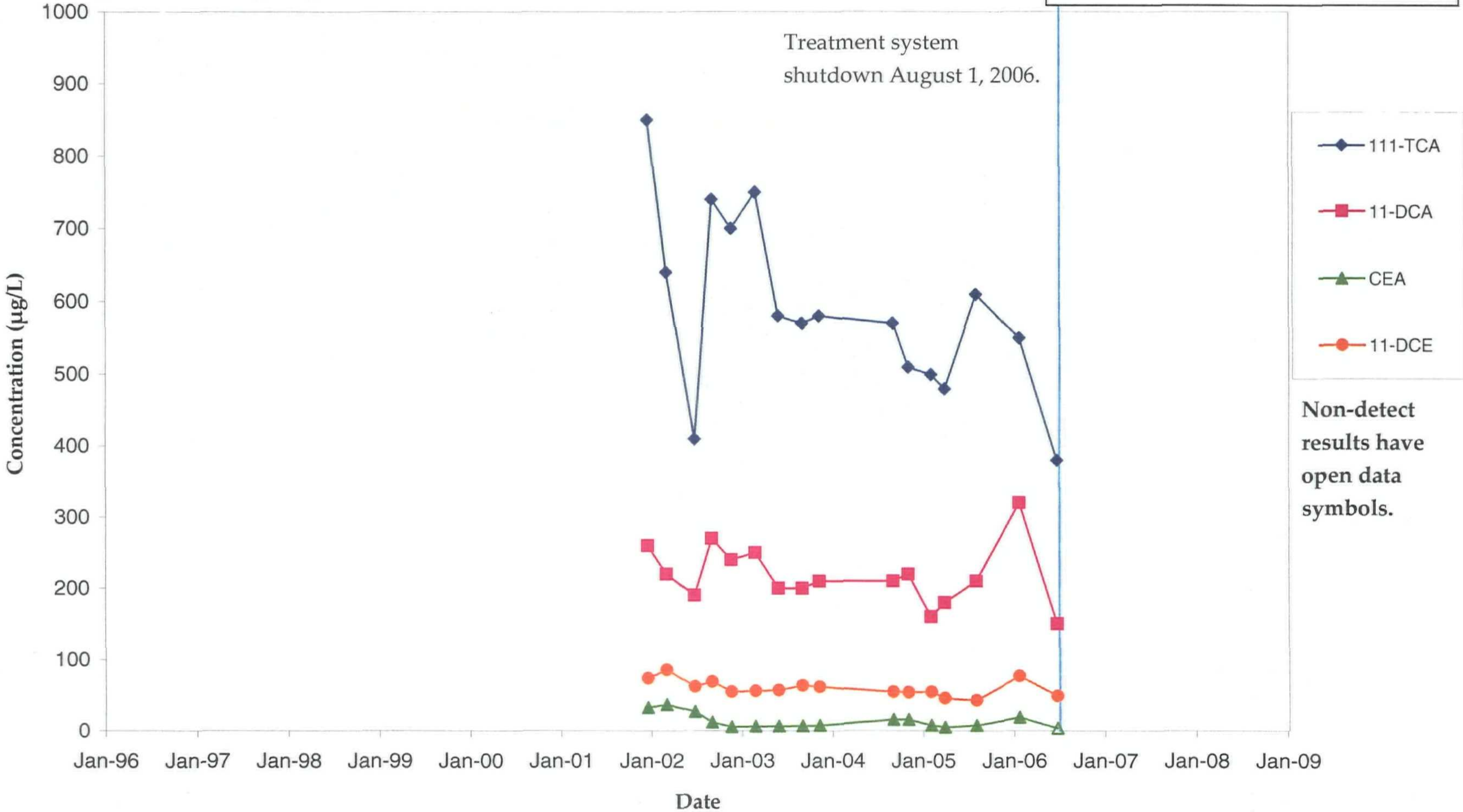
Non-detect results have open data symbols.

08

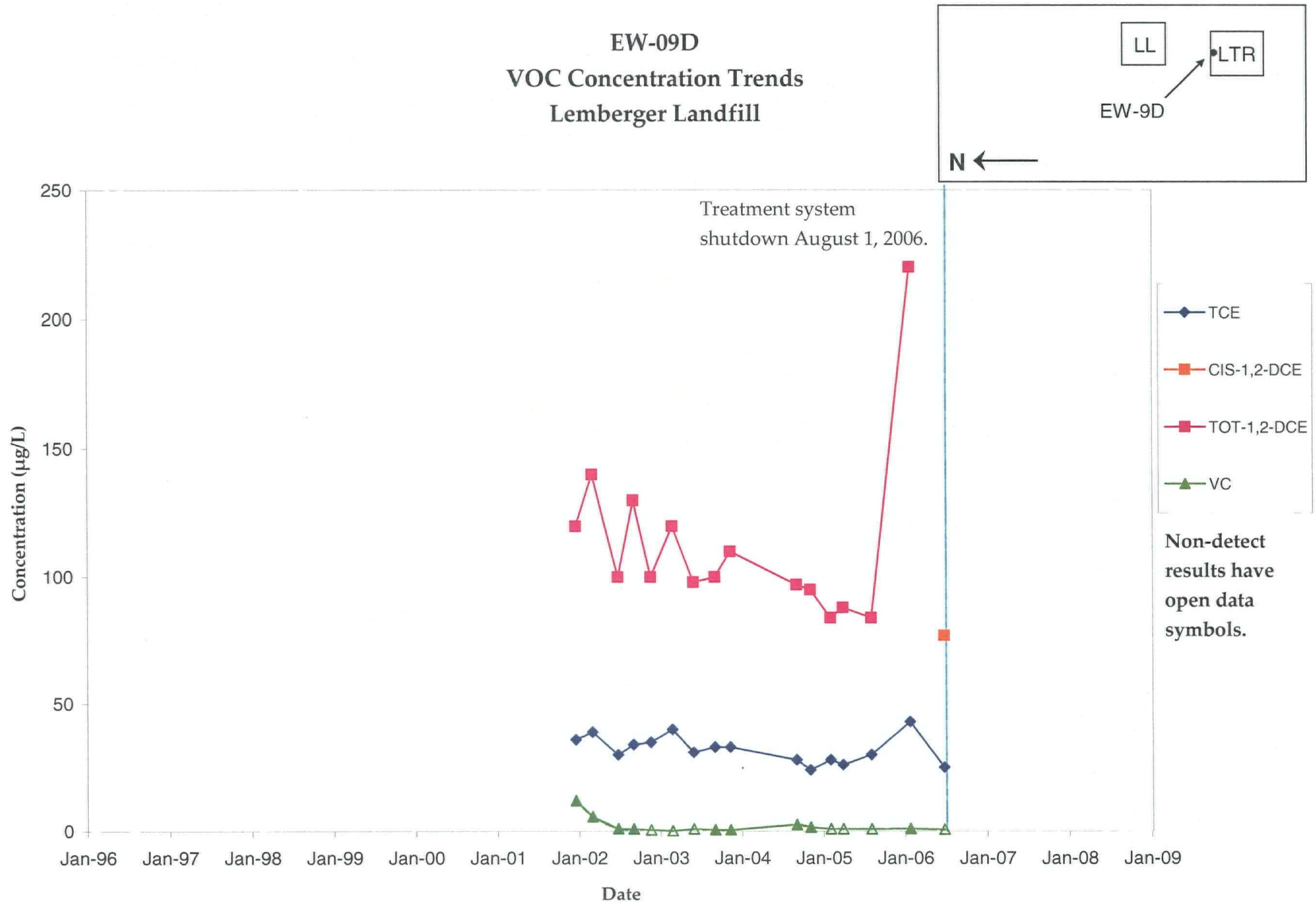
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

EW-09D
VOC Concentration Trends
Lemberger Landfill





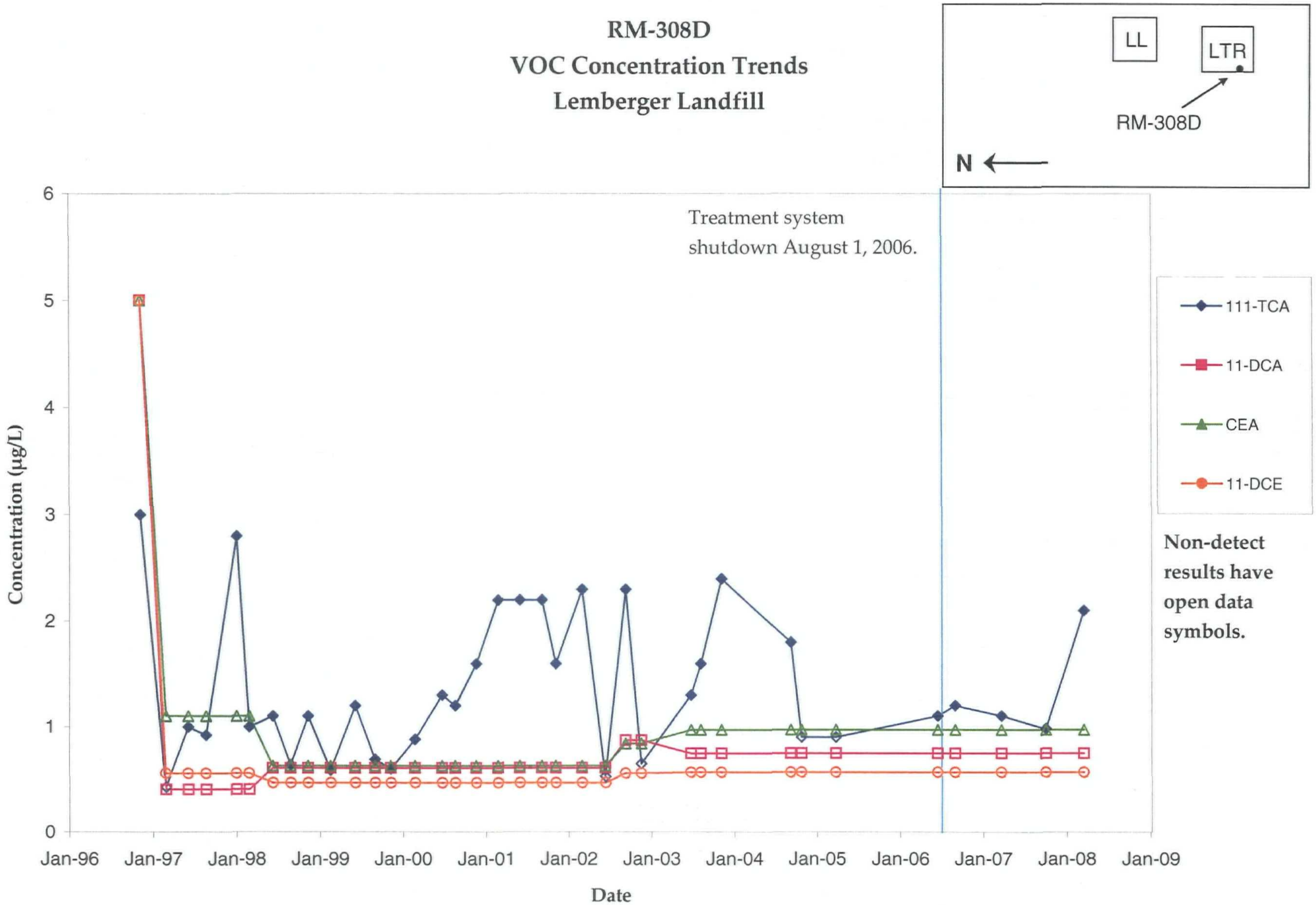
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



8

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

RM-308D
VOC Concentration Trends
Lemberger Landfill

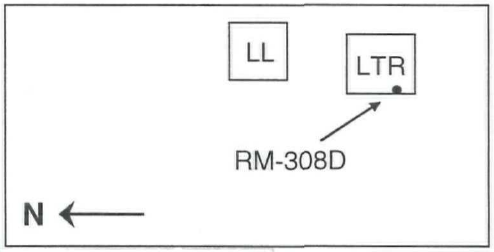


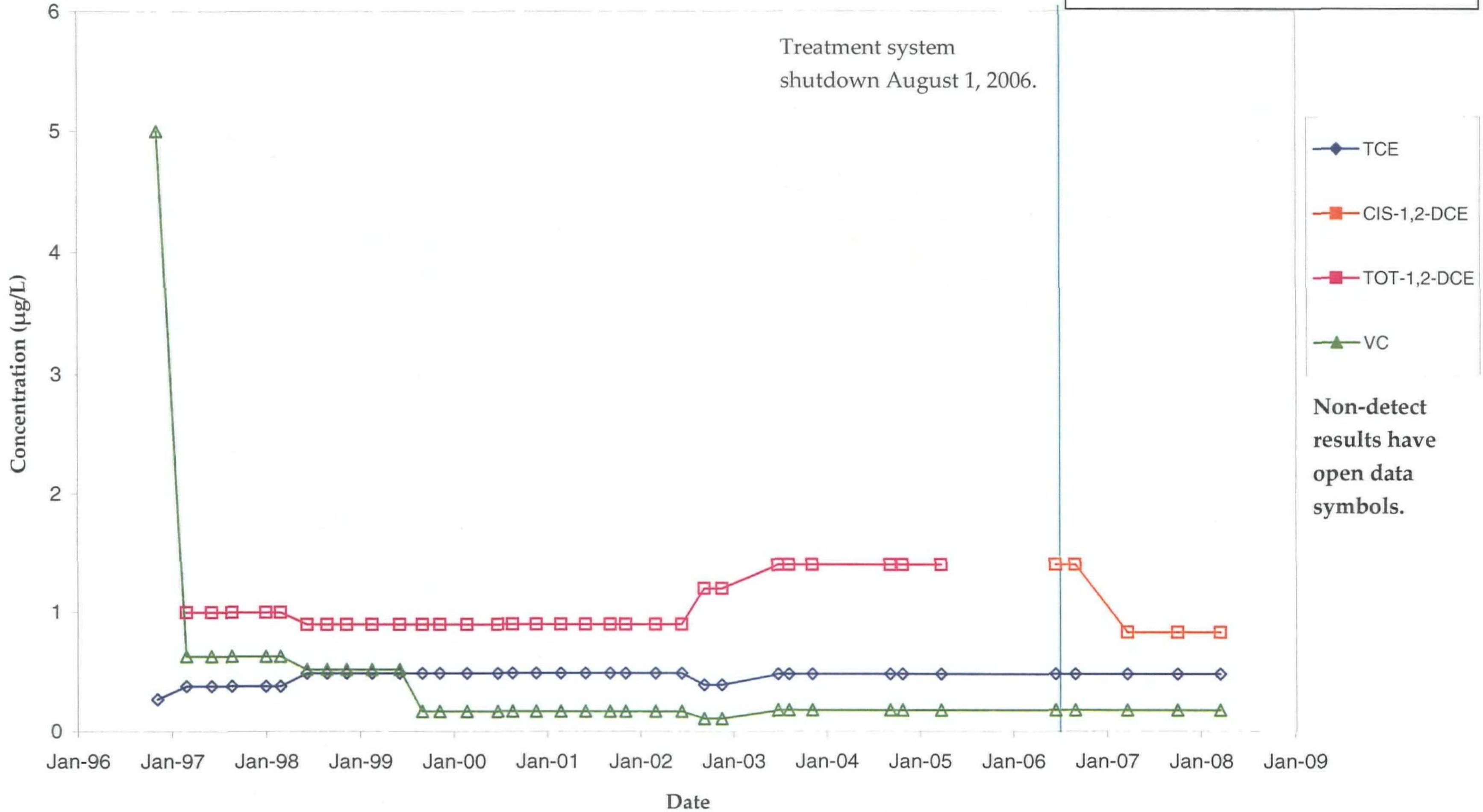
Non-detect results have open data symbols.

83

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

RM-308D
VOC Concentration Trends
Lemberger Landfill

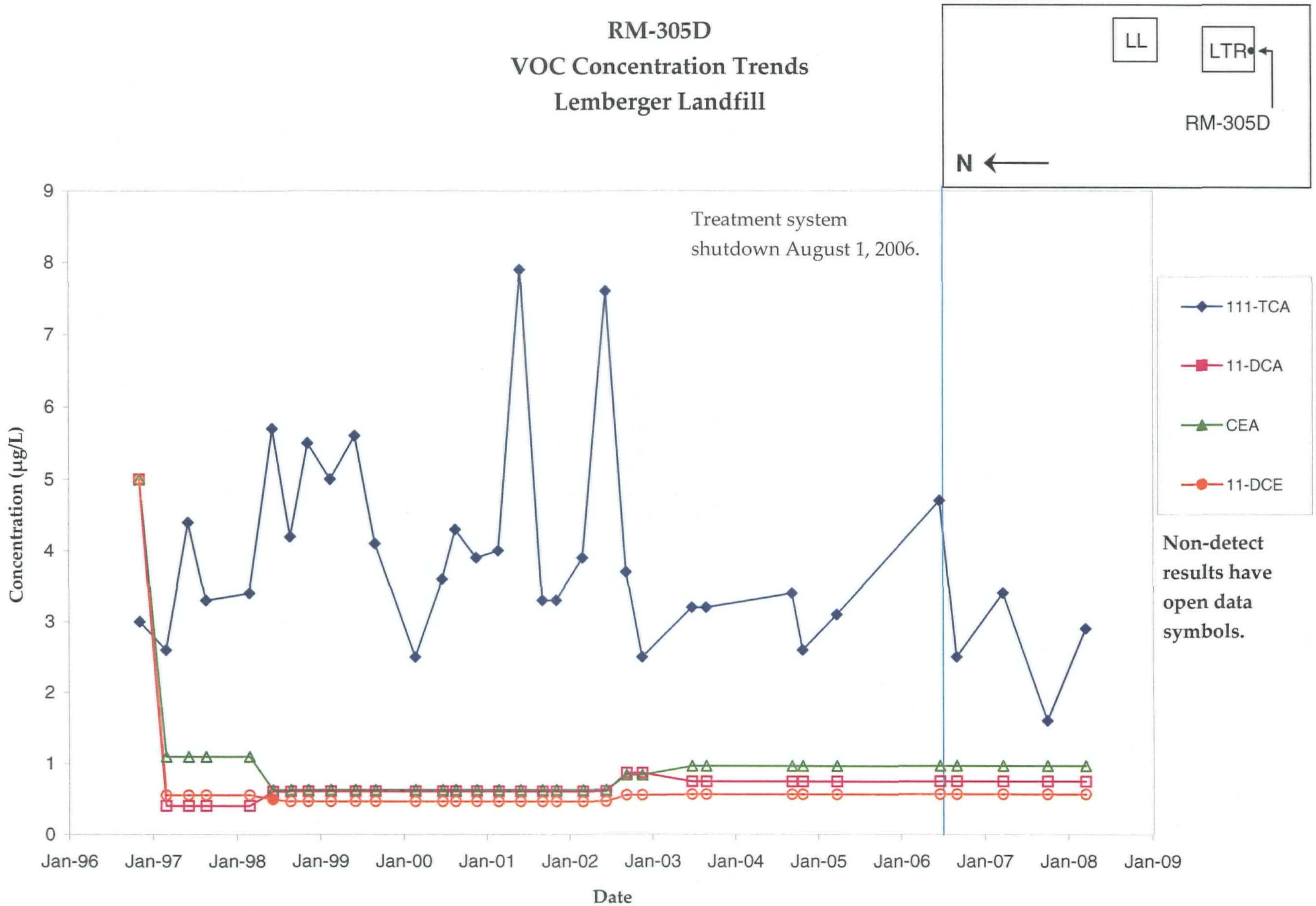




Non-detect results have open data symbols.

84

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



85

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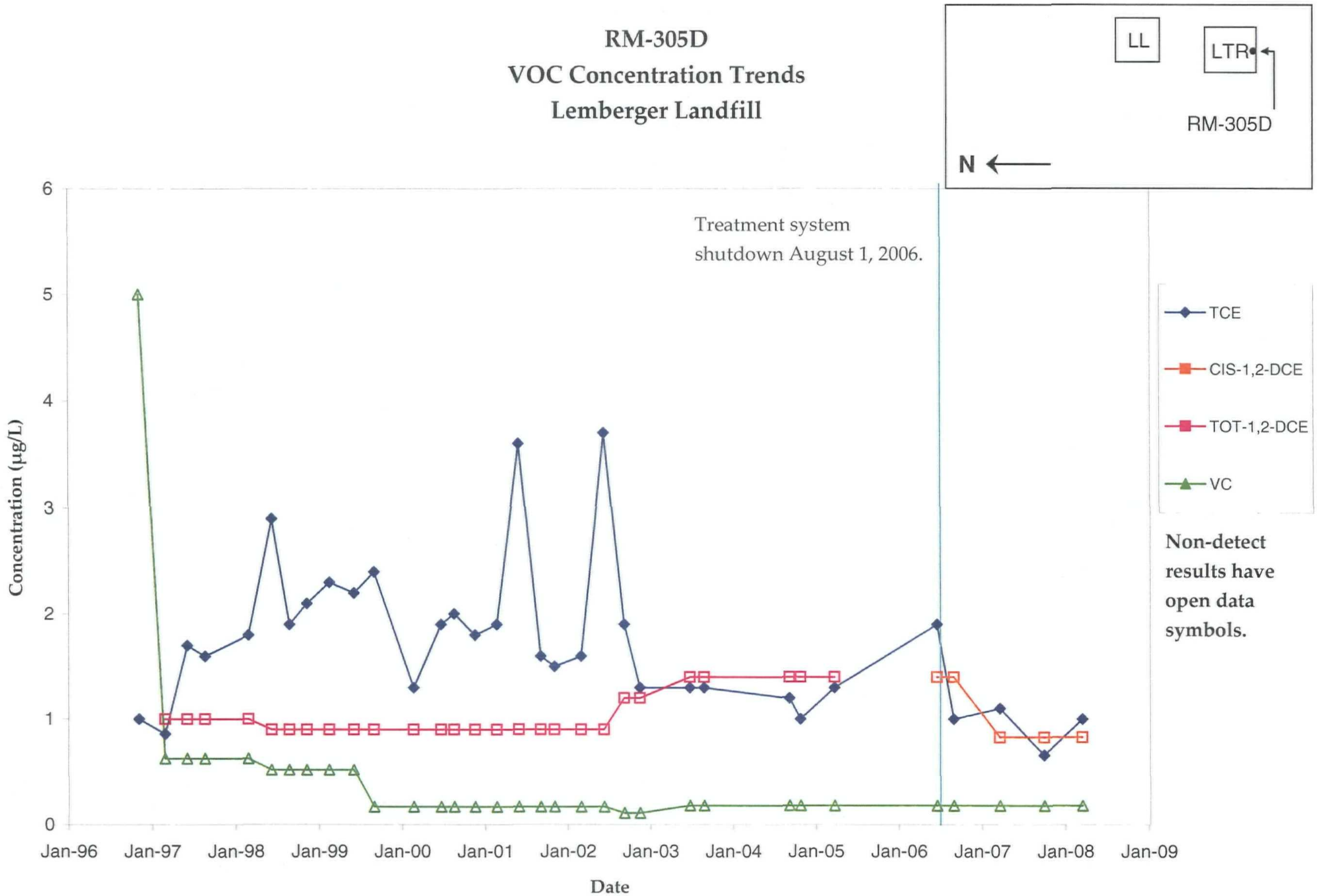
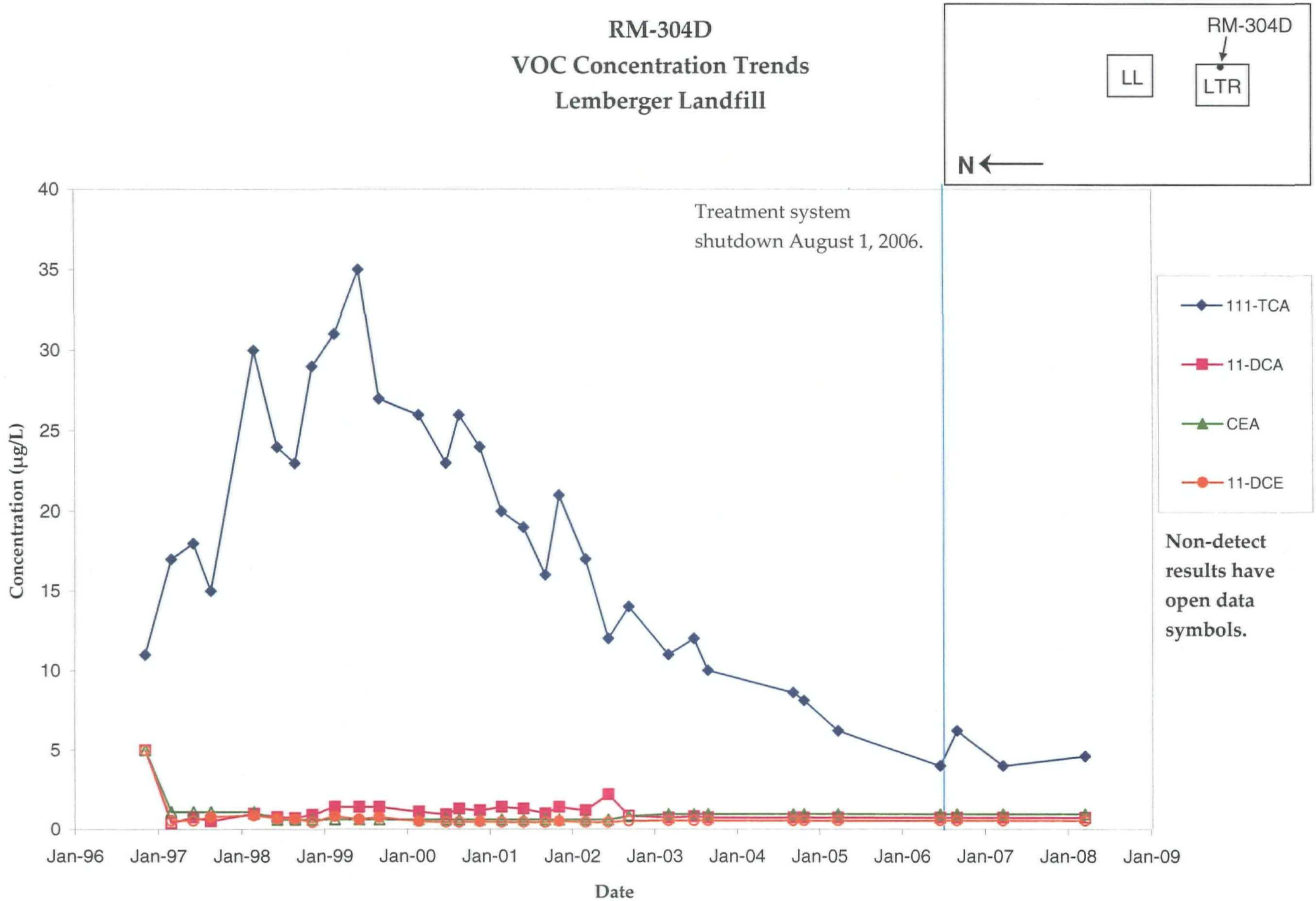


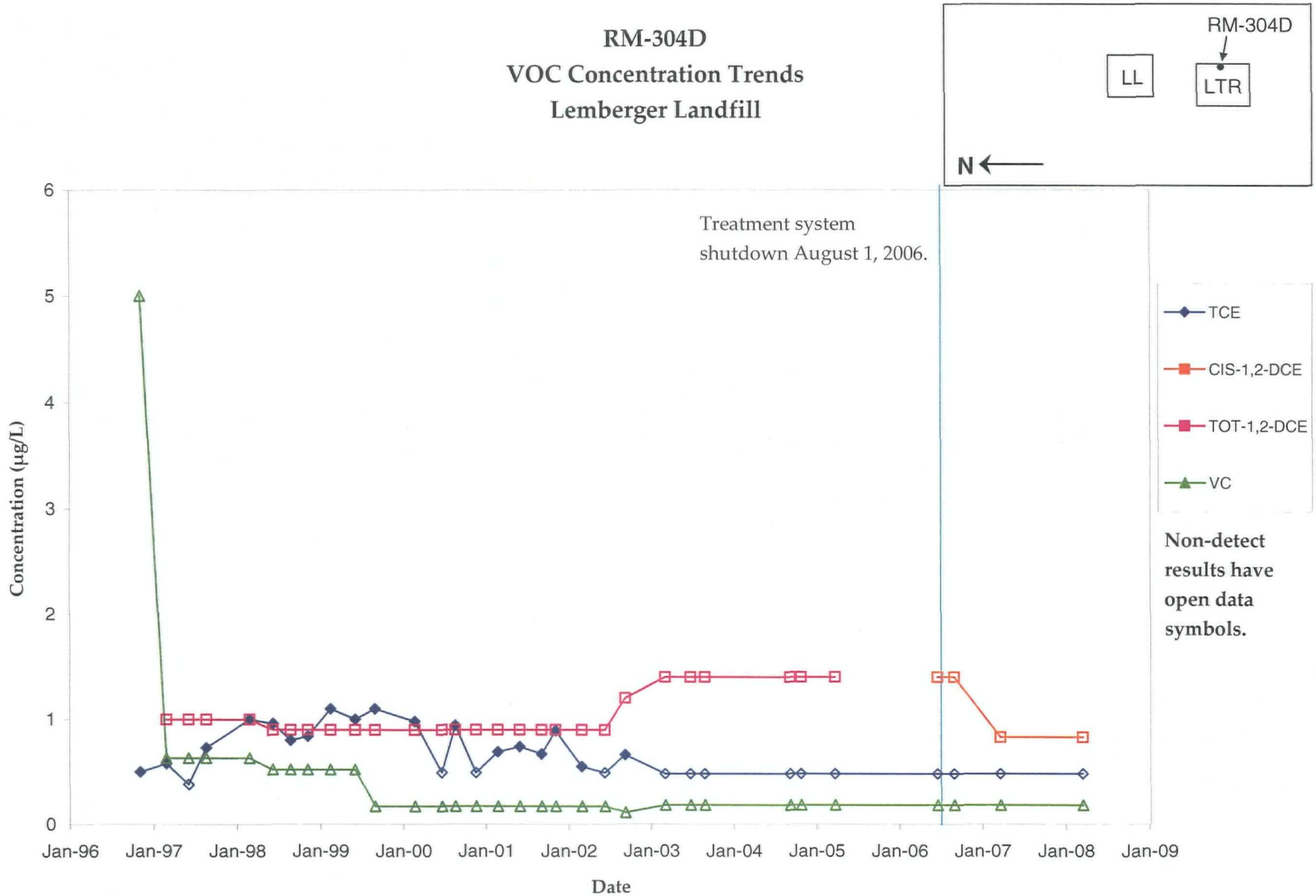
98

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

RM-304D
VOC Concentration Trends
Lemberger Landfill

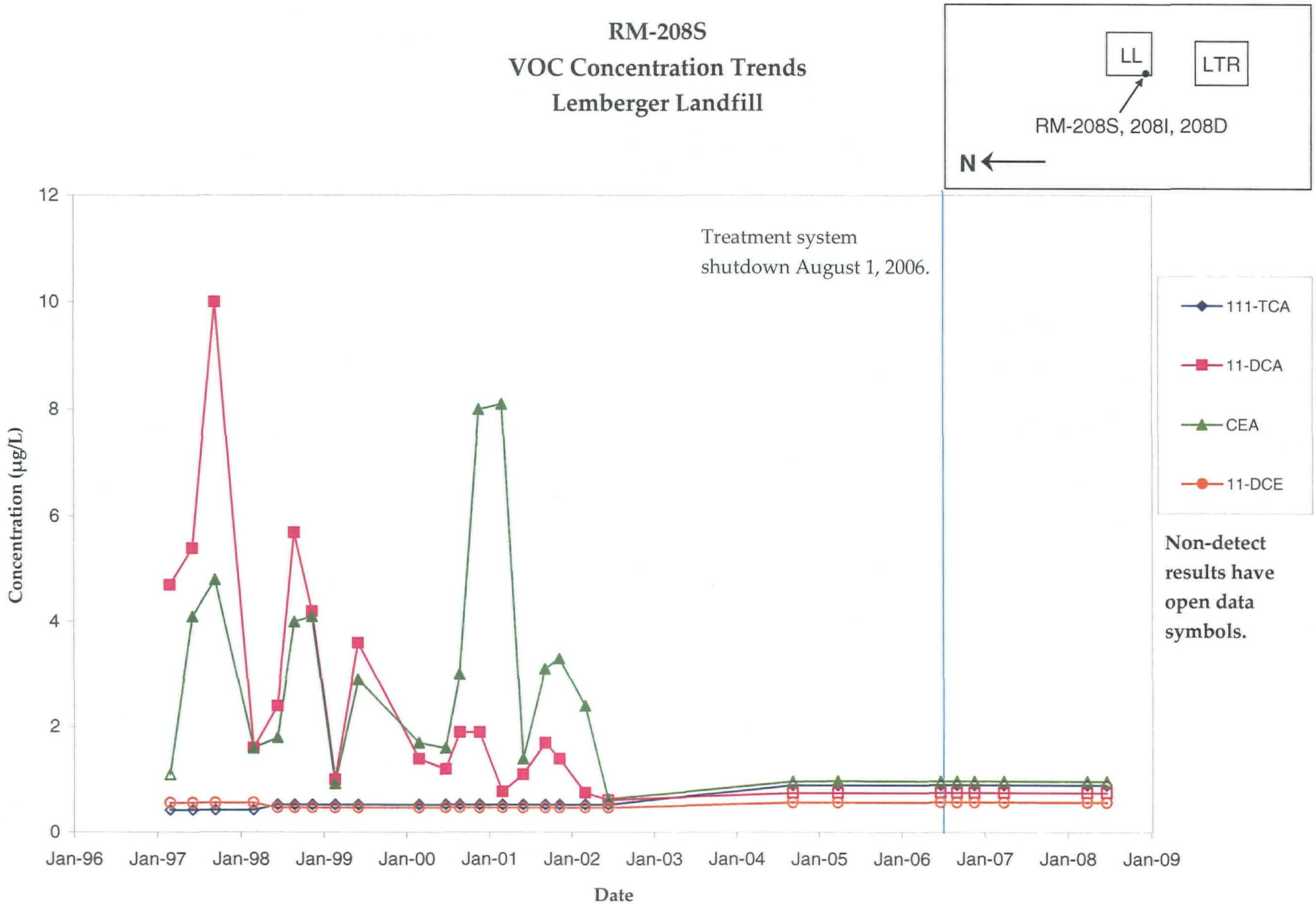


I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

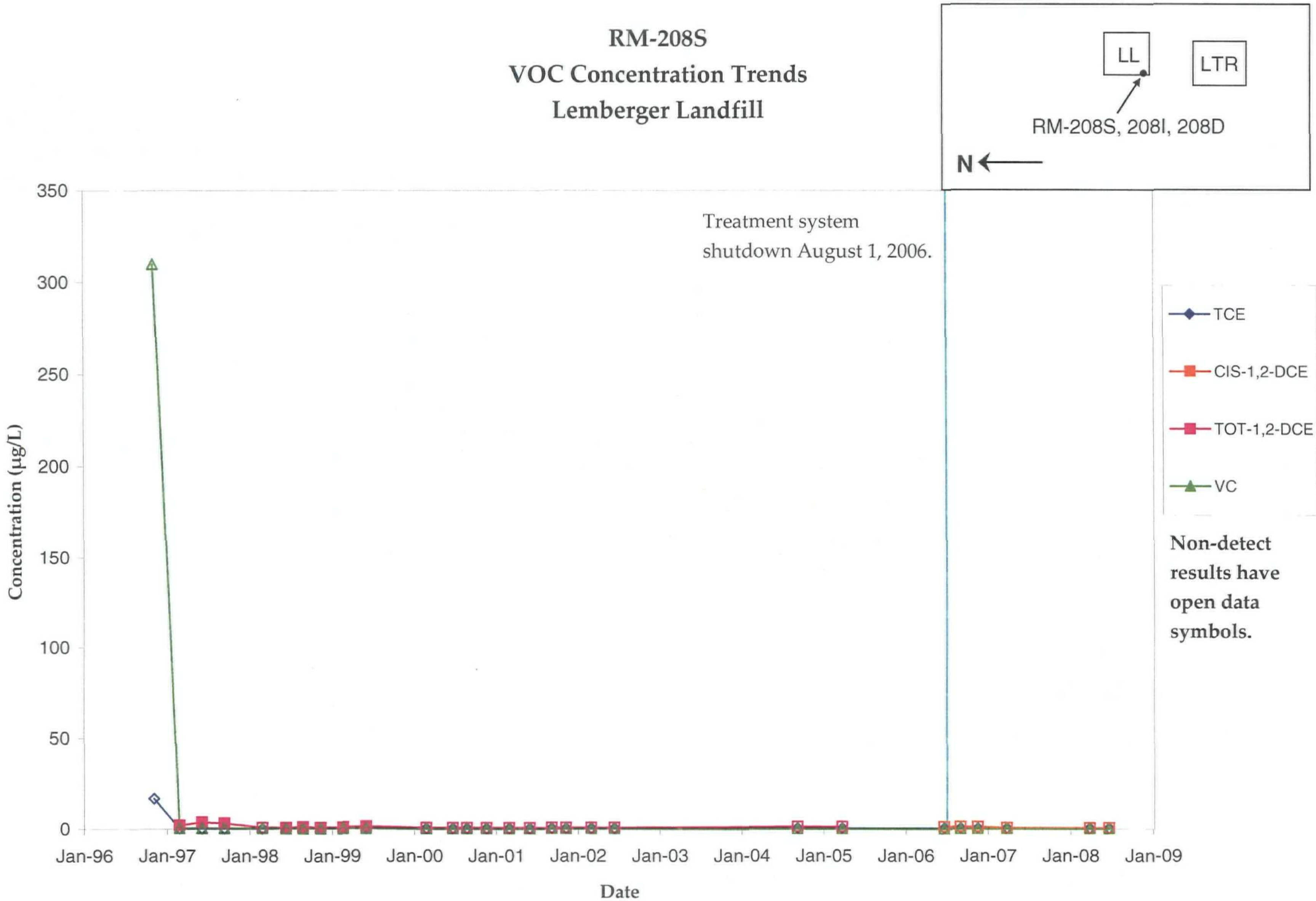
RM-208S
VOC Concentration Trends
Lemberger Landfill



98

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008

RM-208S
VOC Concentration Trends
Lemberger Landfill

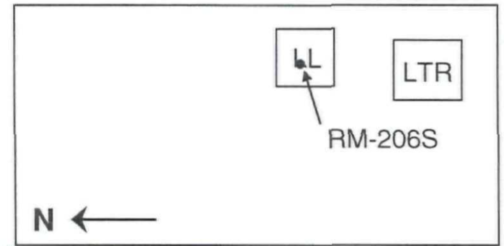


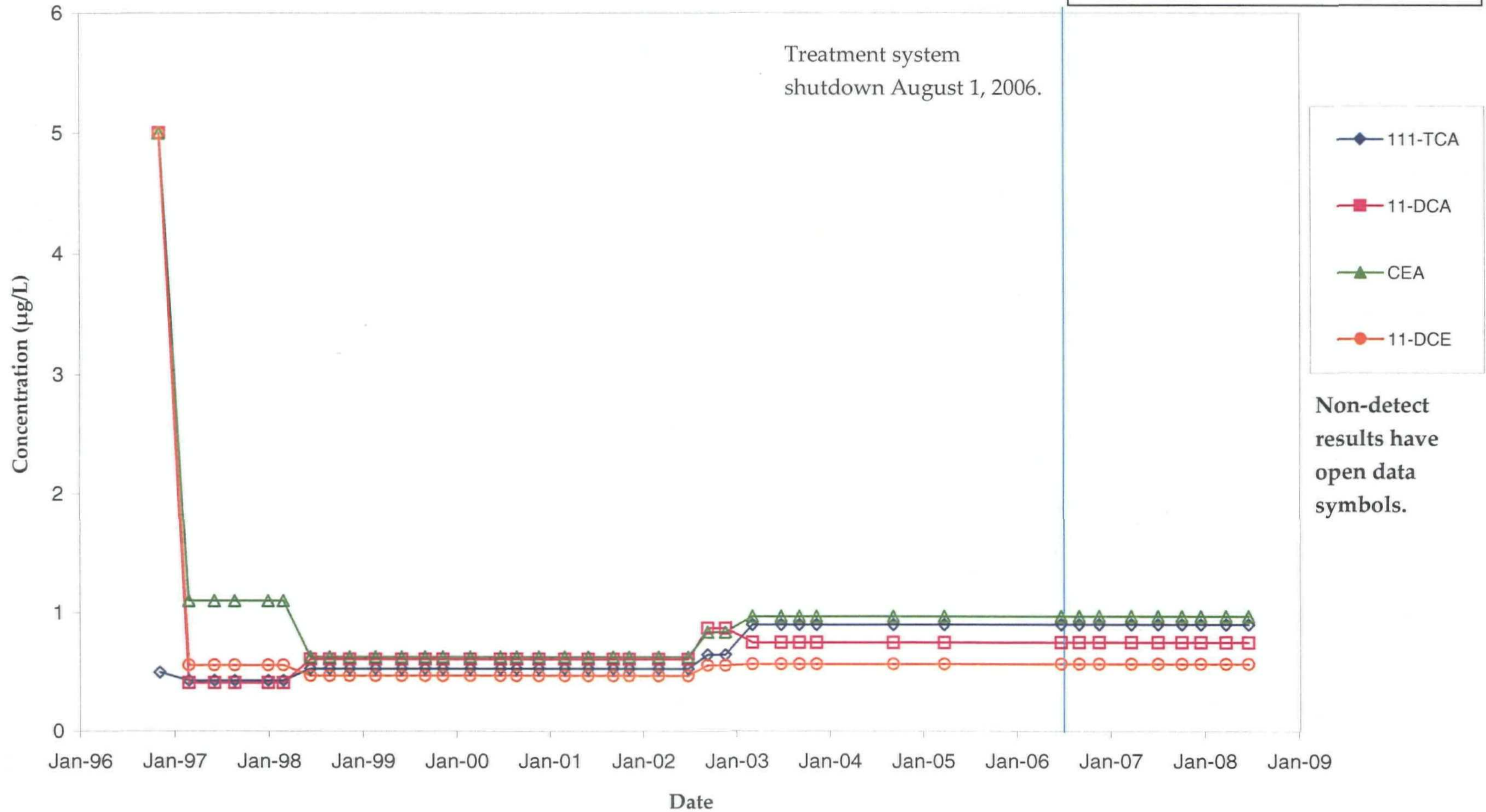
Non-detect results have open data symbols.

Qb

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

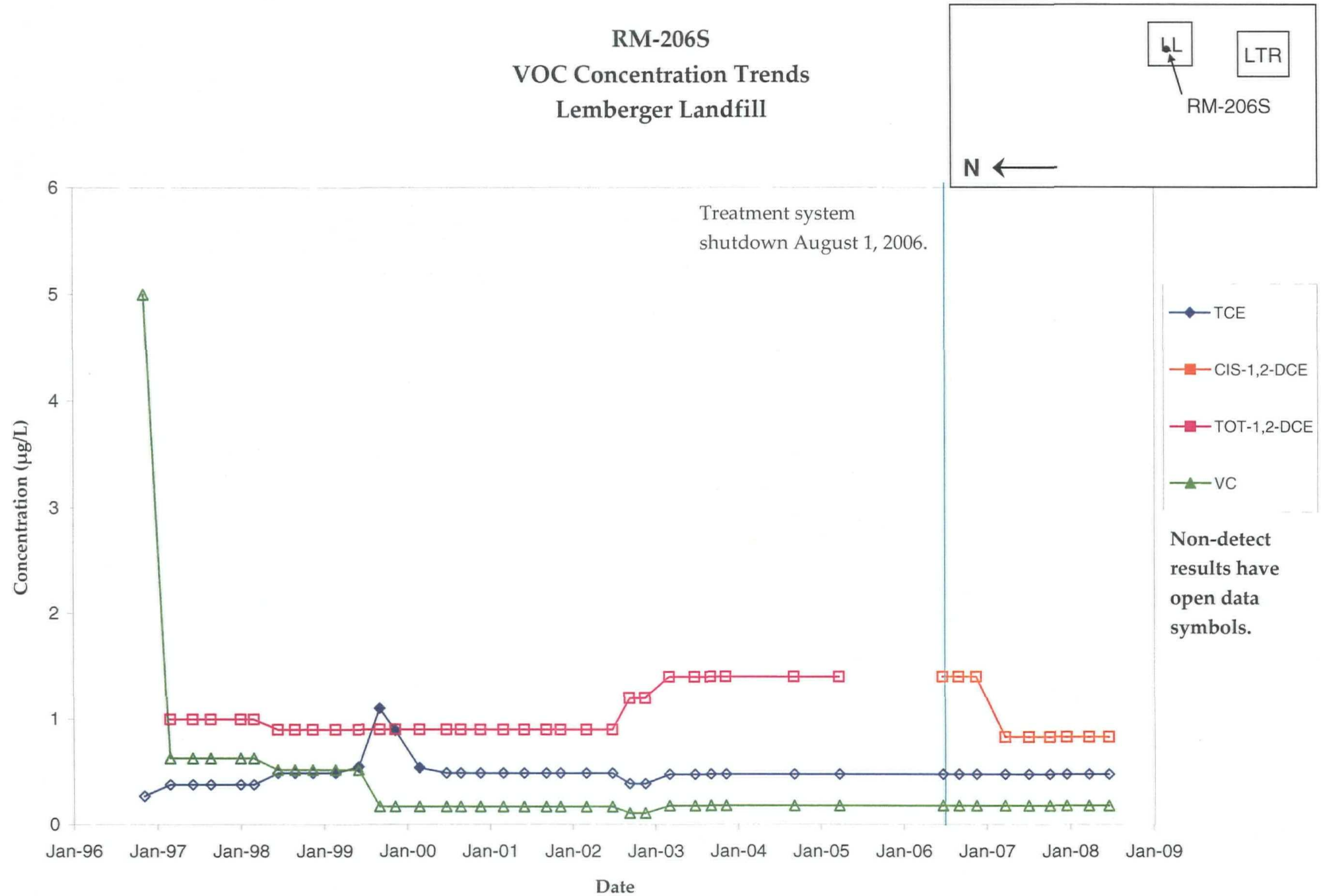
RM-206S
VOC Concentration Trends
Lemberger Landfill





16

RM-206S
VOC Concentration Trends
Lemberger Landfill

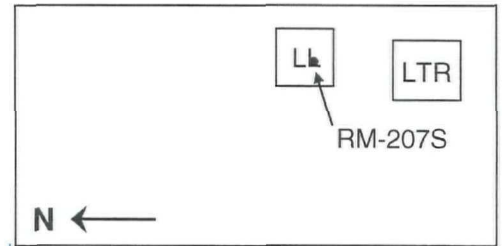


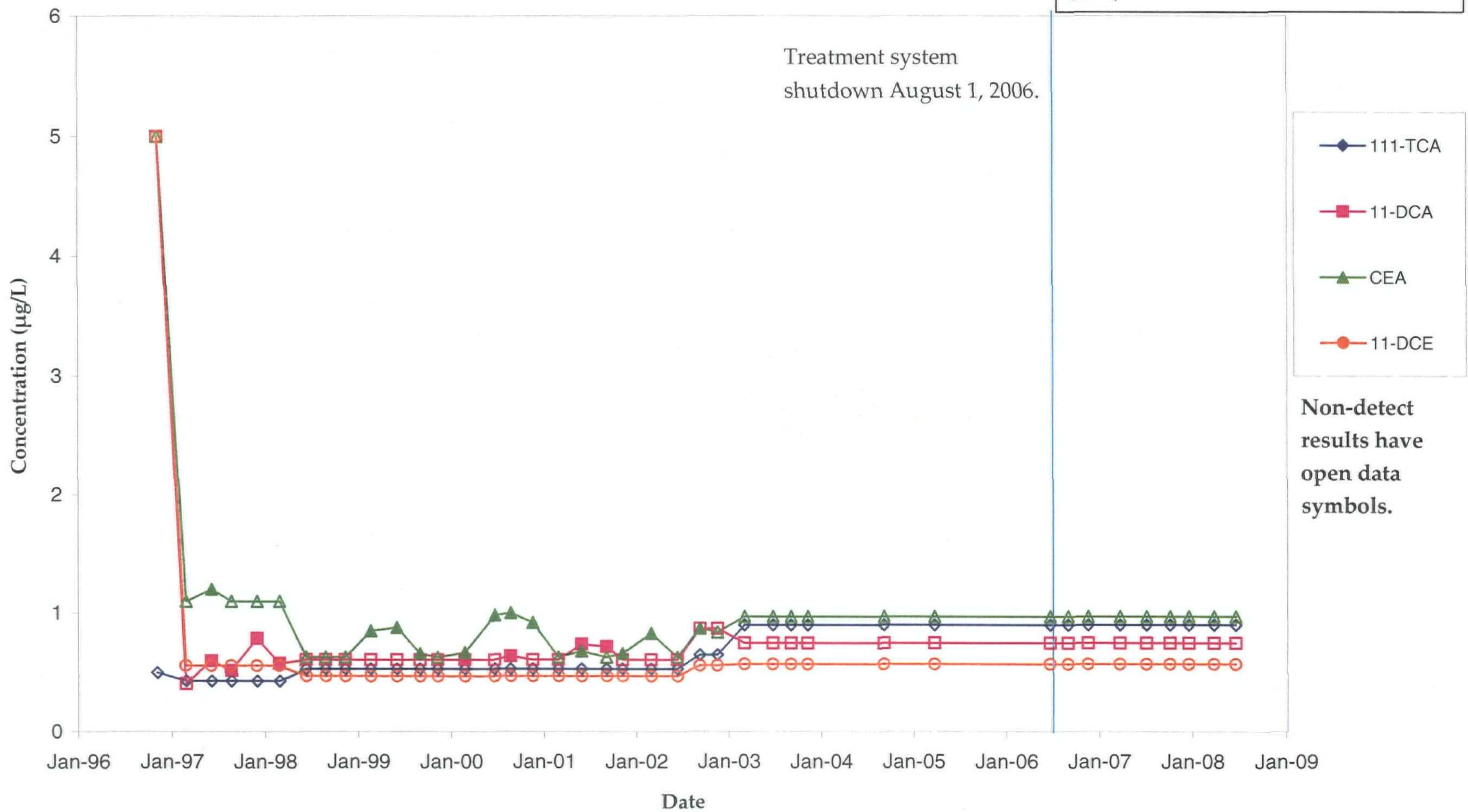
Non-detect results have open data symbols.

tb

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

RM-207S
VOC Concentration Trends
Lemberger Landfill





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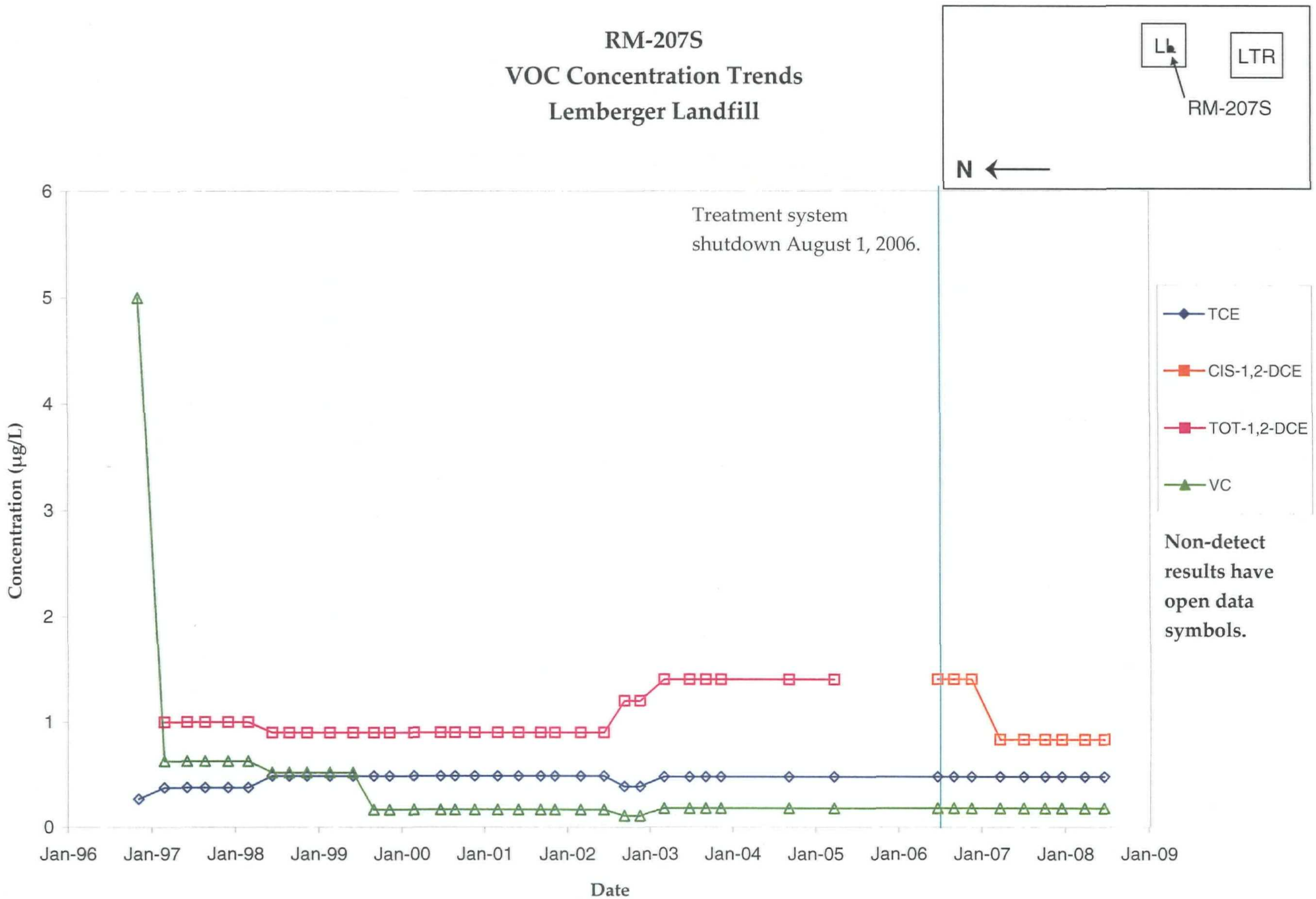
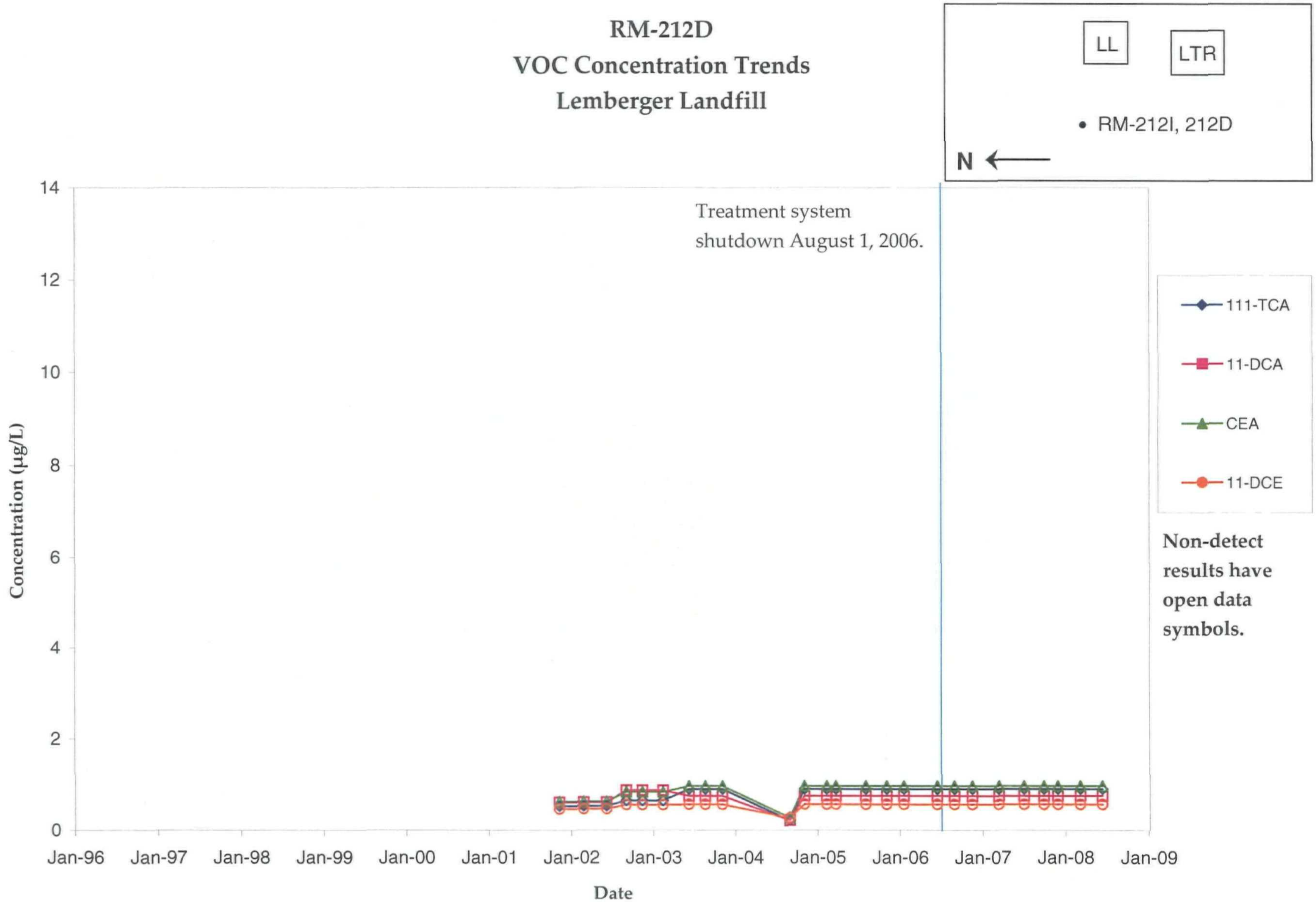


94

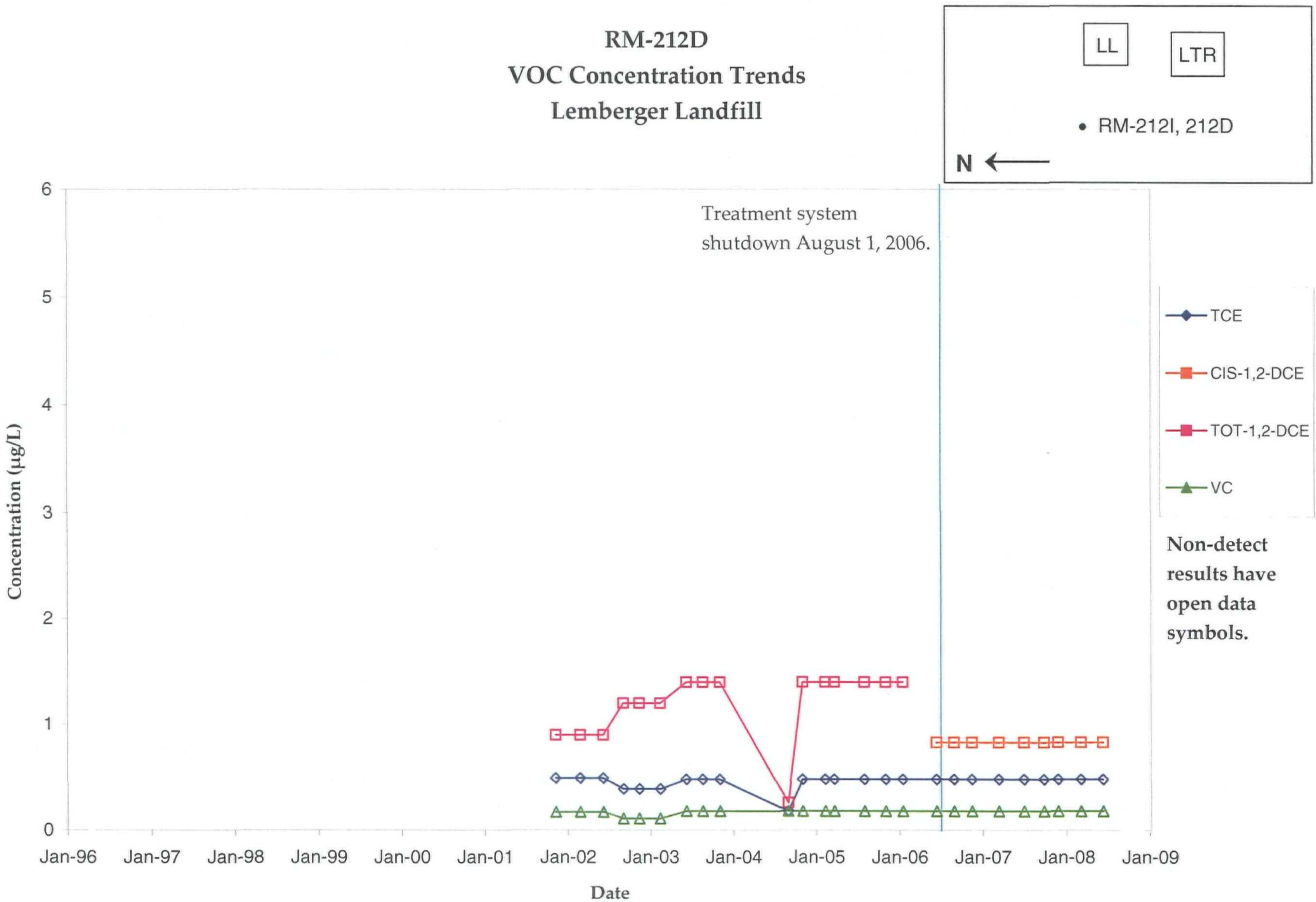
I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008

RM-212D
VOC Concentration Trends
Lemberger Landfill



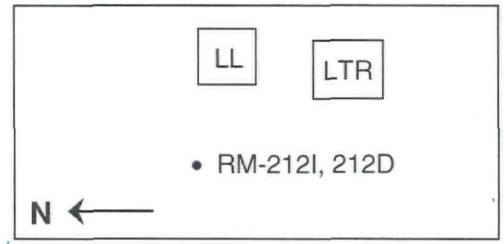
95

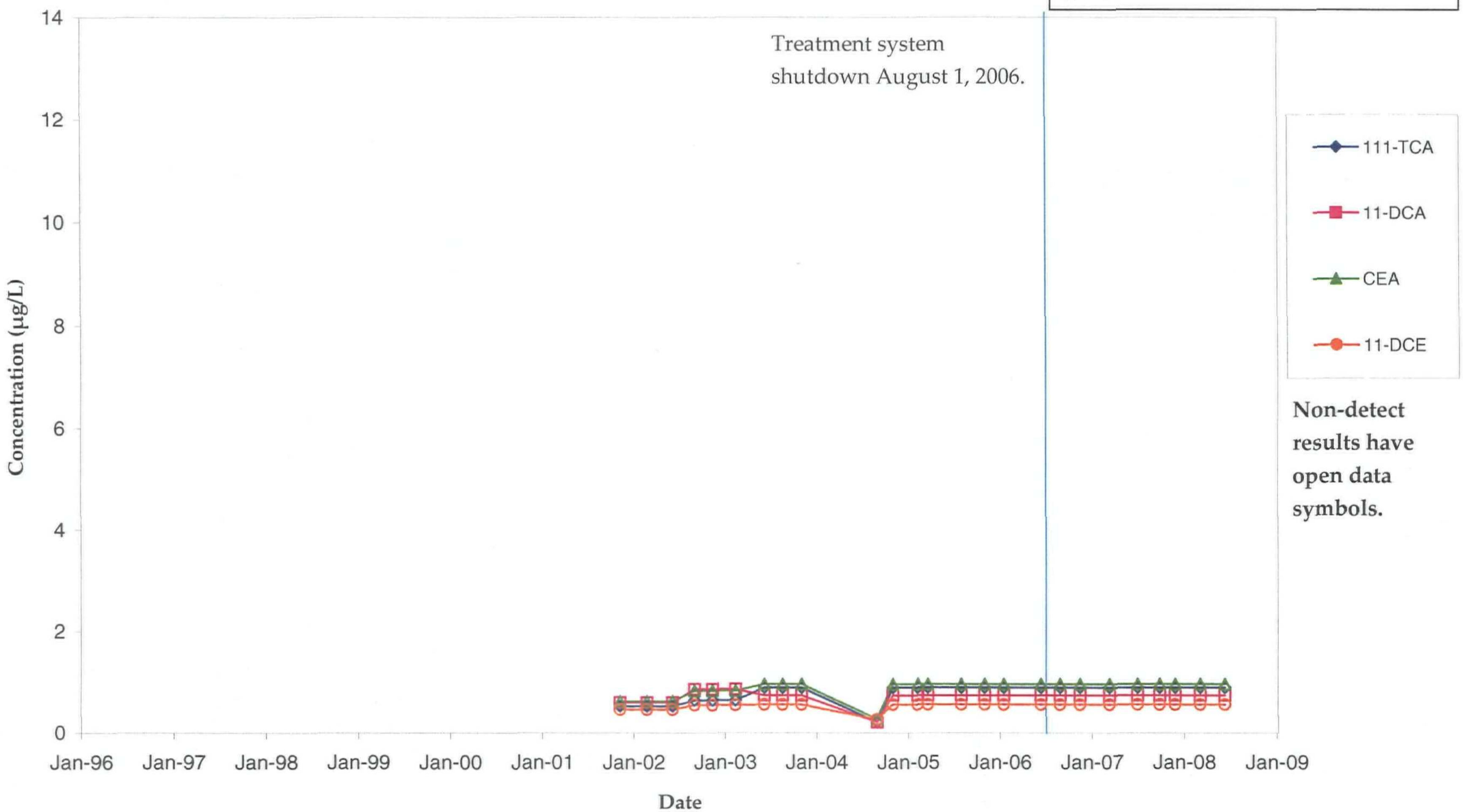
I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008


RM-212D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-212I, 212D
N
Treatment system shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.
Concentration (µg/L)
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date

96

RM-212I
VOC Concentration Trends
Lemberger Landfill

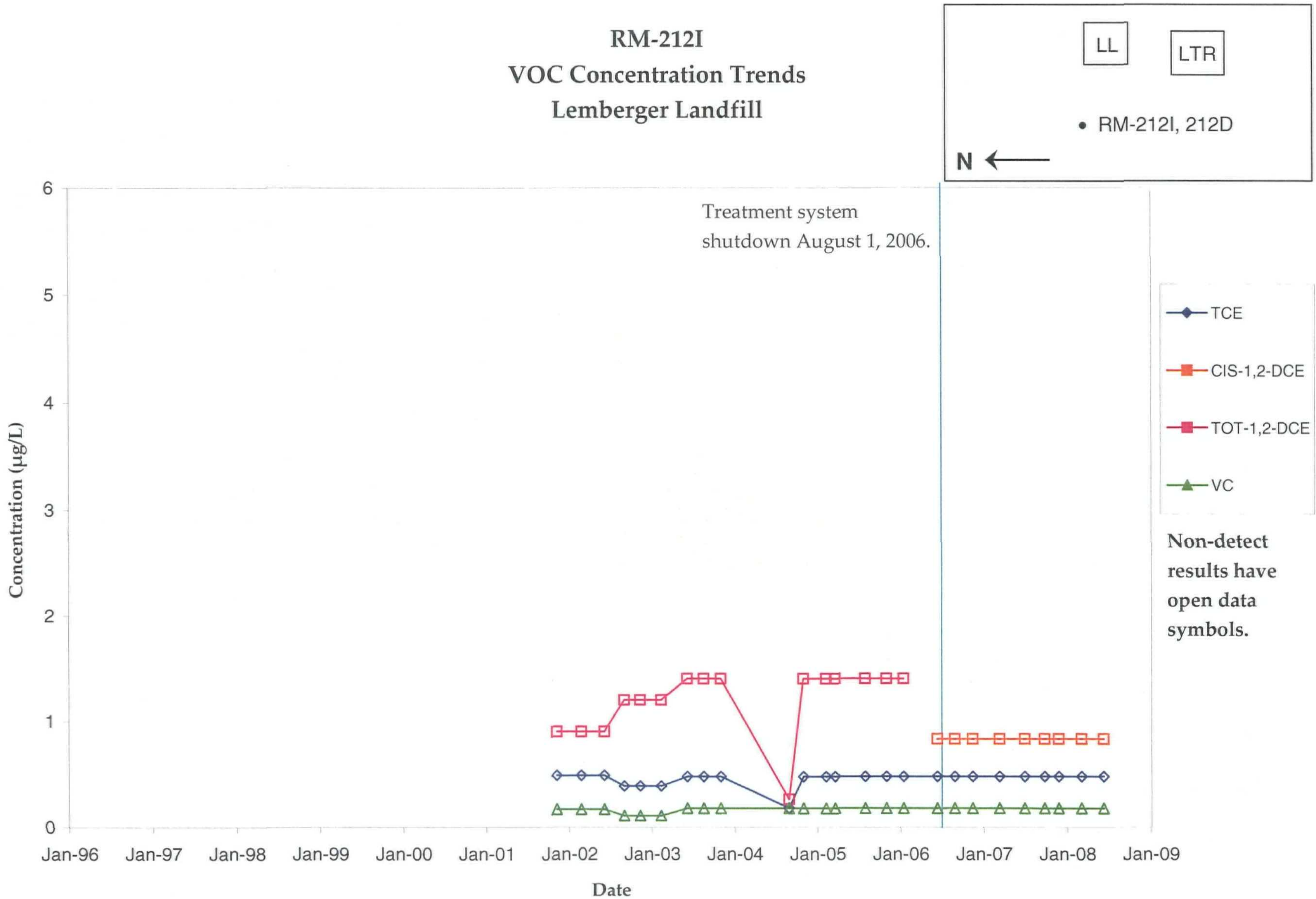




Non-detect results have open data symbols.

Lb

I:\WPMSN\PJT\00-03457\46\000345746-007.XLS 12/18/2008



98

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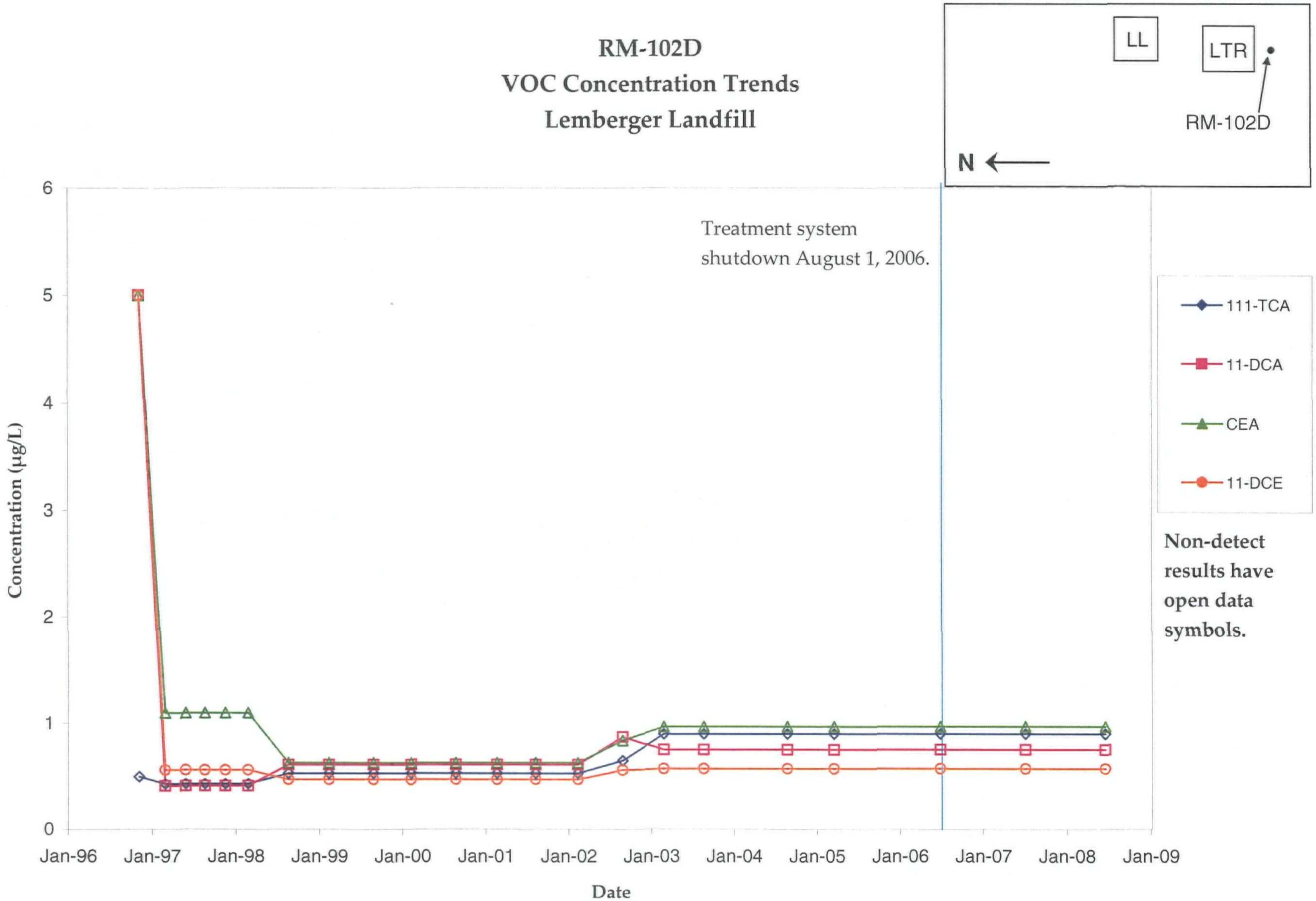

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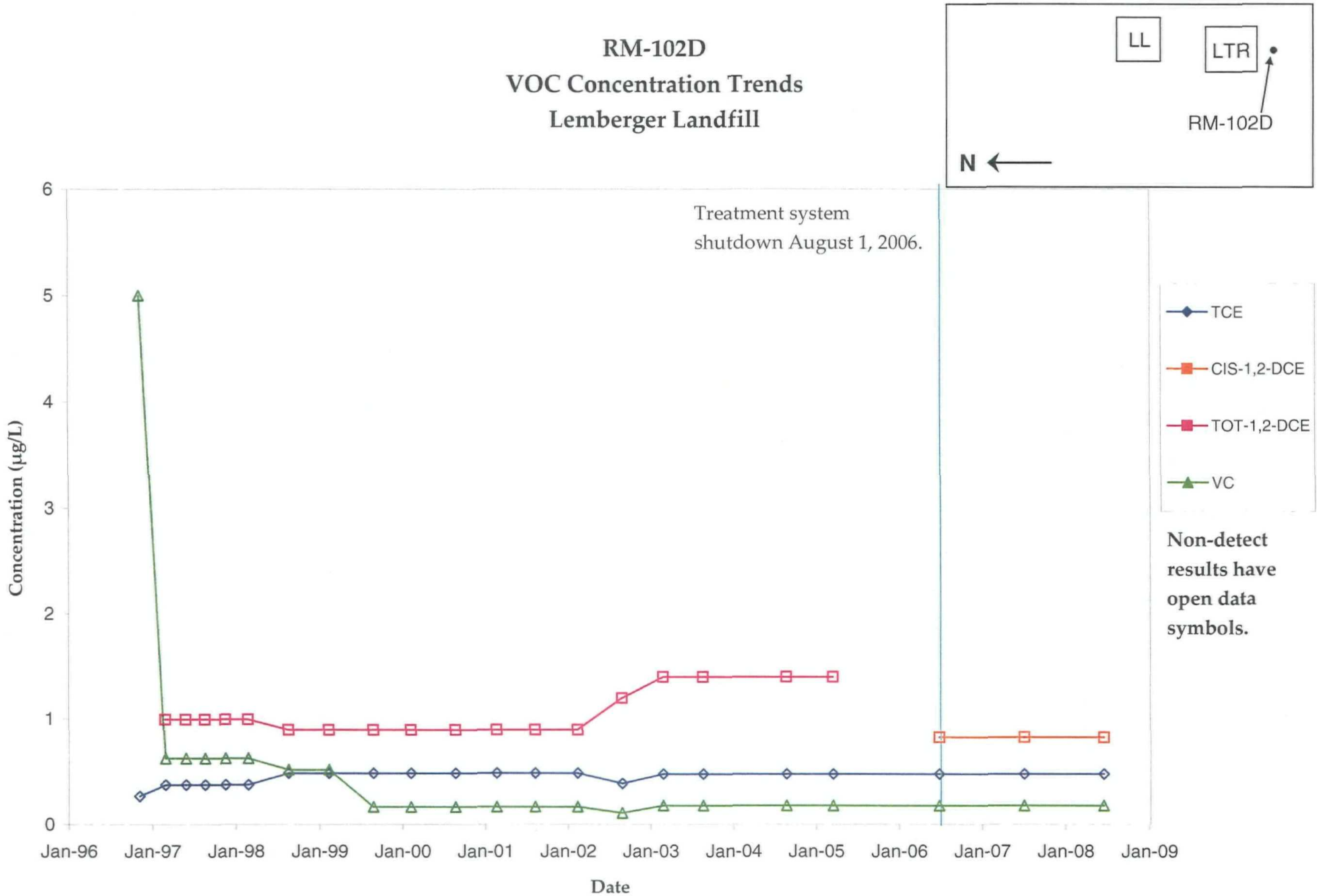

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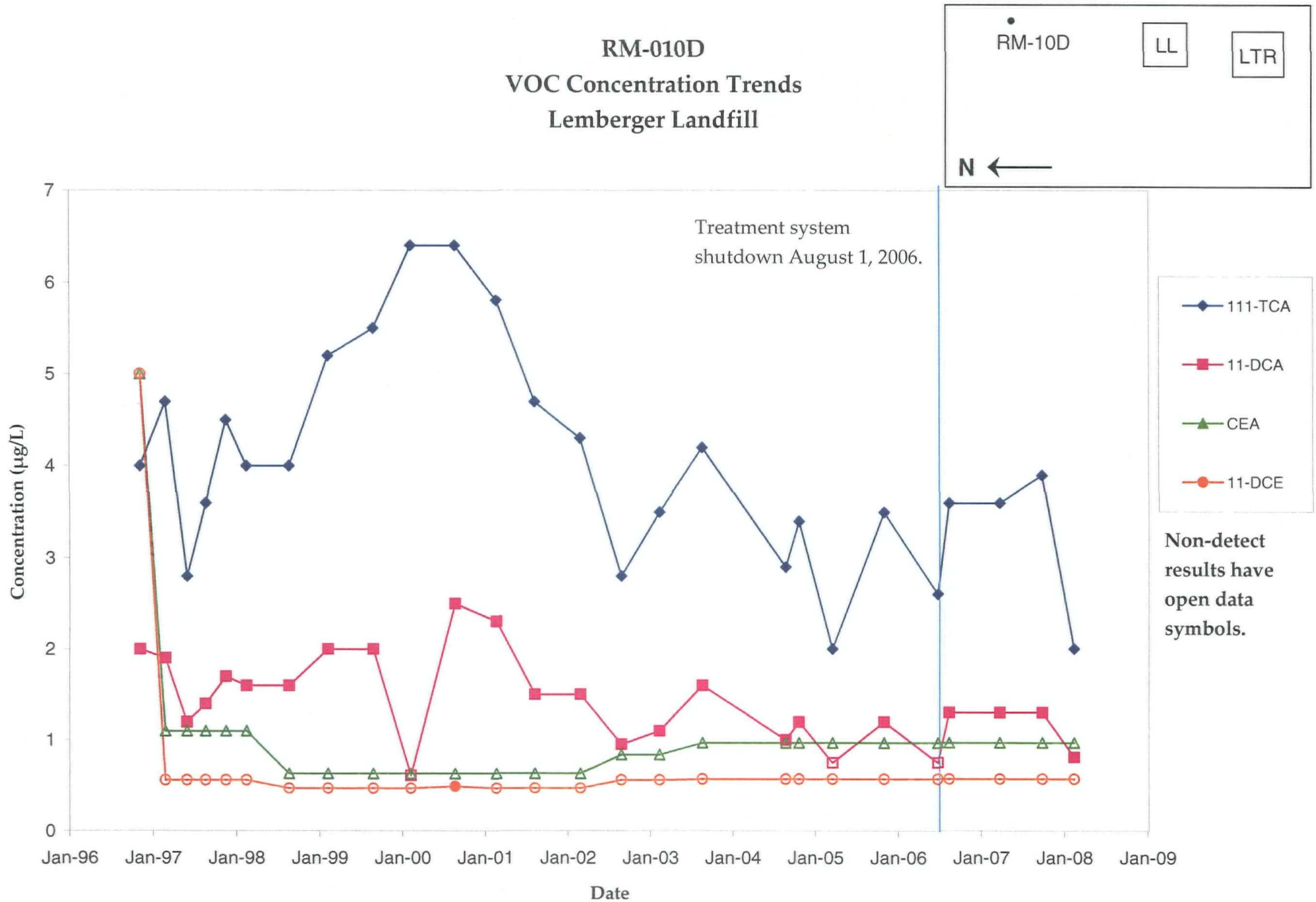

101

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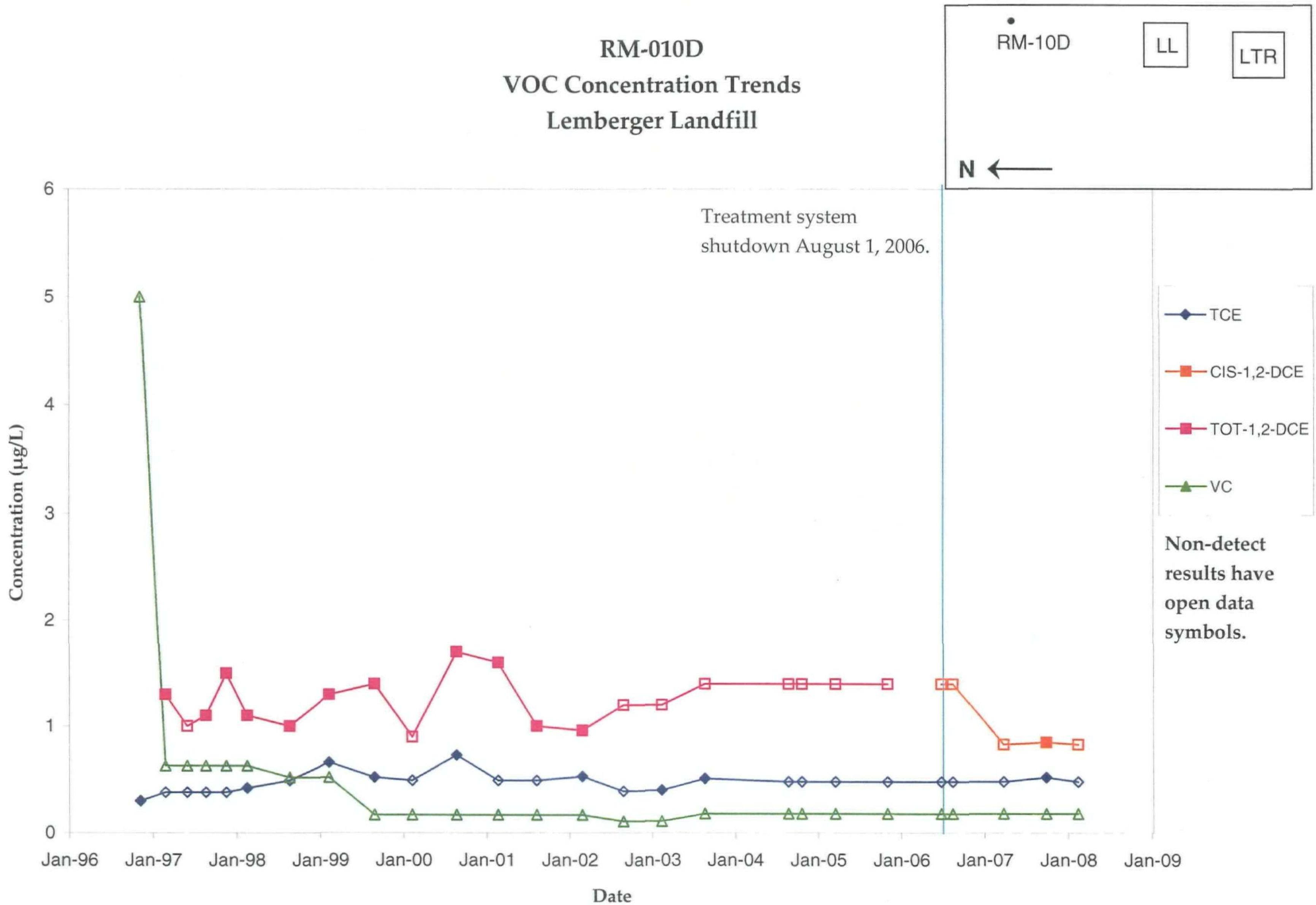
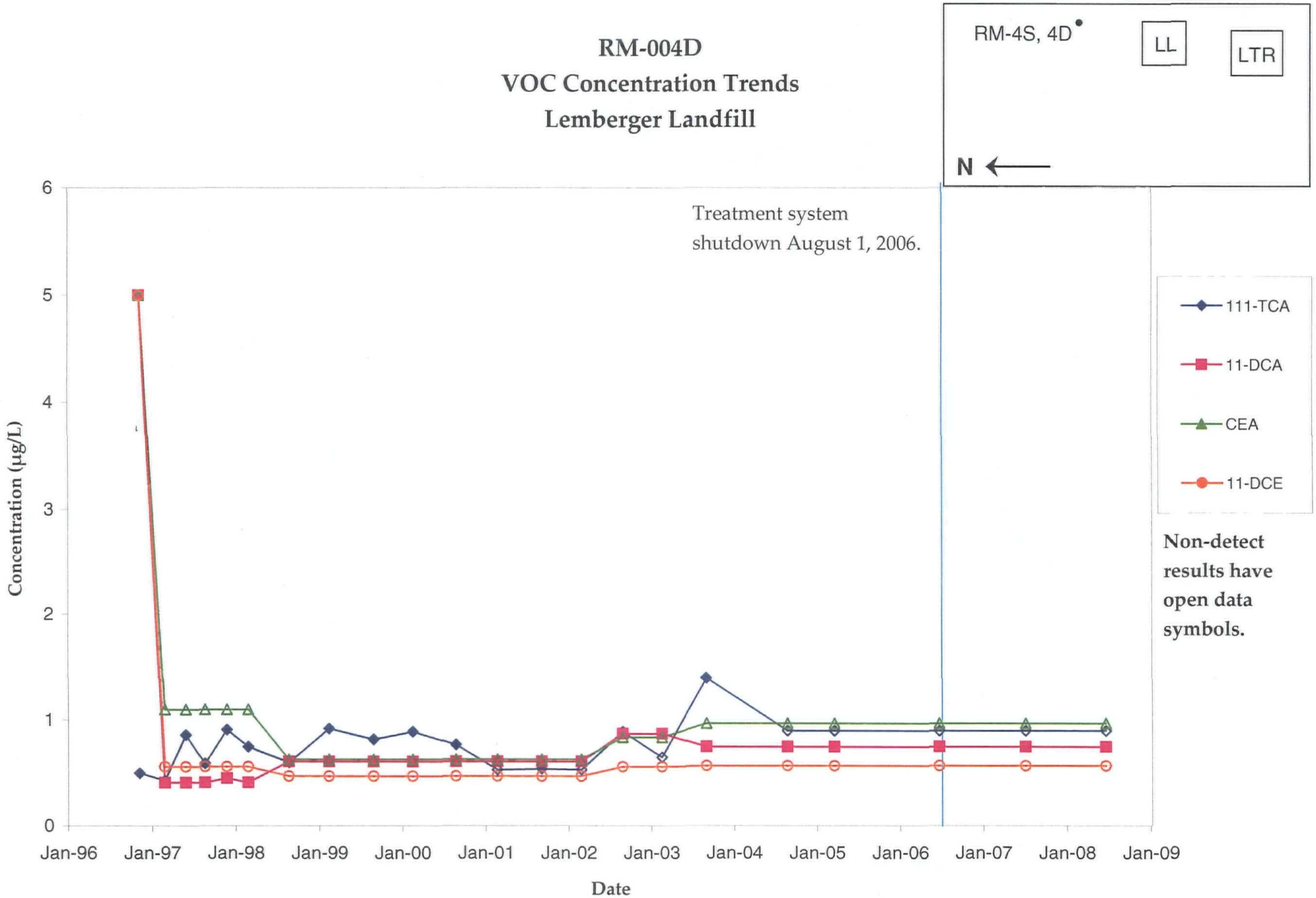


201

I:\WPMSN\PJT\00-03457\46\000345746-008.XLS 12/18/2008



103

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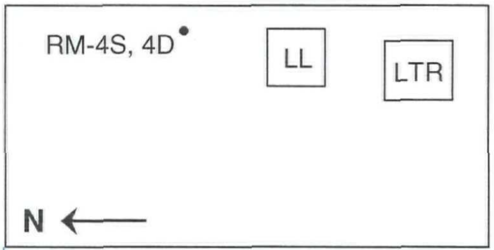
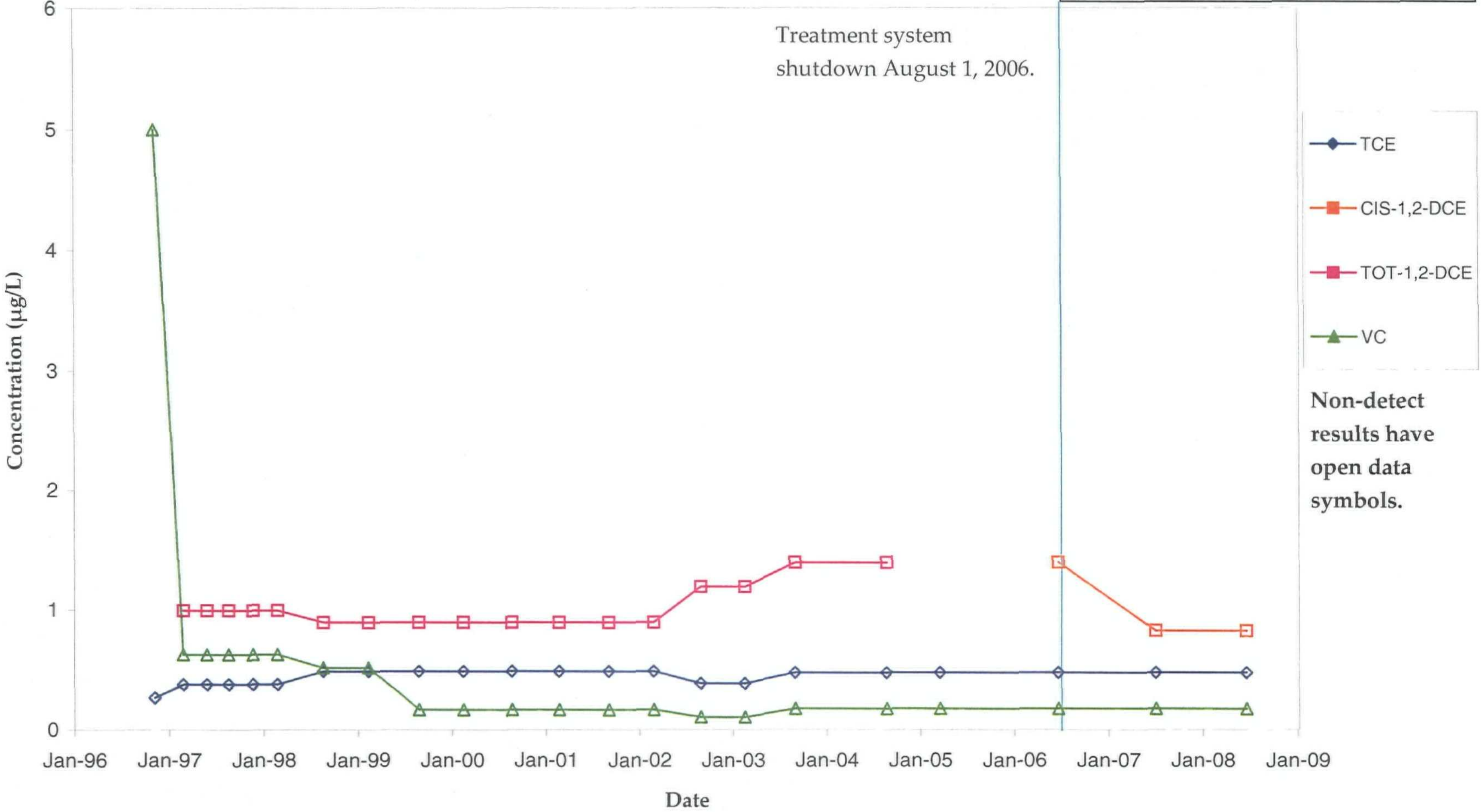
RM-004D
VOC Concentration Trends
Lemberger Landfill





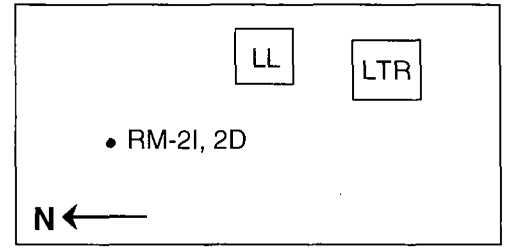
Non-detect results have open data symbols.

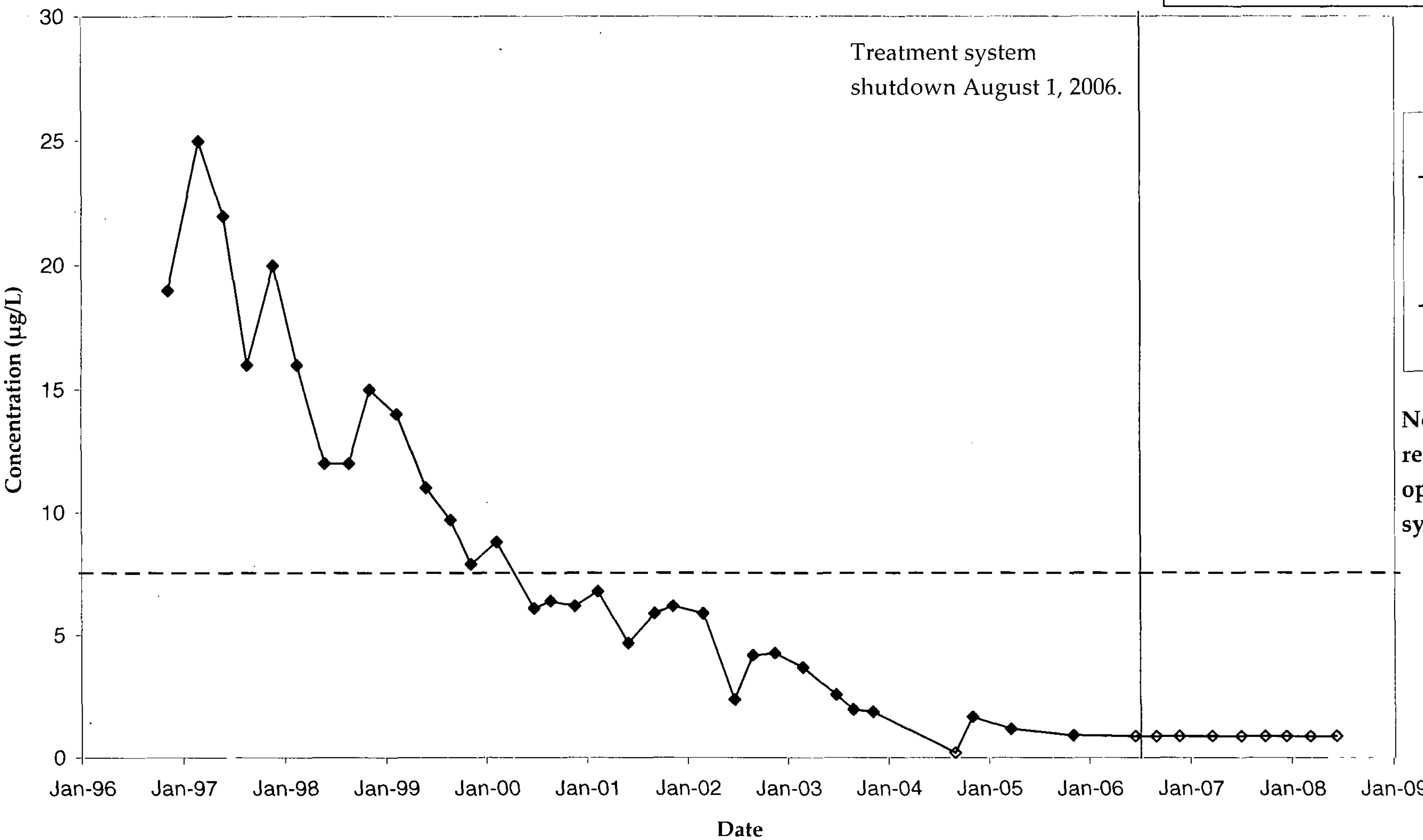
104/104

Appendix F
Results of Statistical Analysis for VOC Analytical Data

Appendix G
Sentinel Well VOC Trend Plots and Upper Confidence Limit (UCL) Calculations

RM-002D
VOC Concentration Trends
Lemberger Landfill

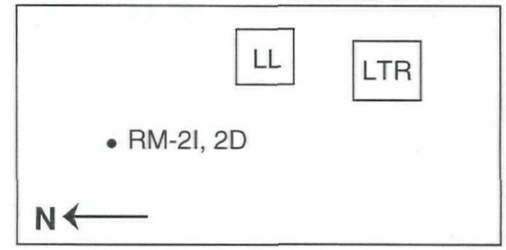


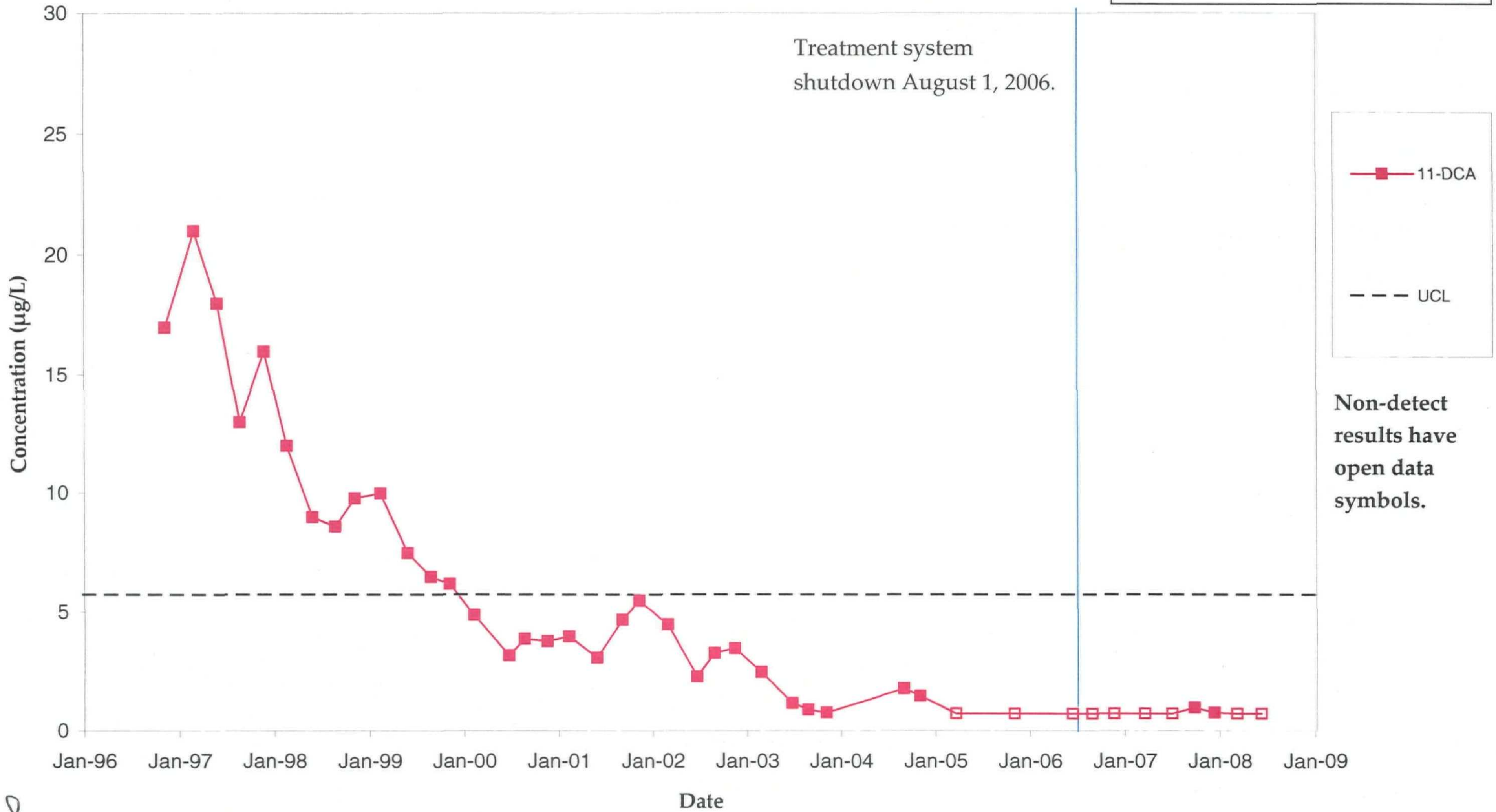


Non-detect results have open data symbols.

I:\WPMSN\PJT\00-03457\46\000345746-010.XLS 12/18/2008

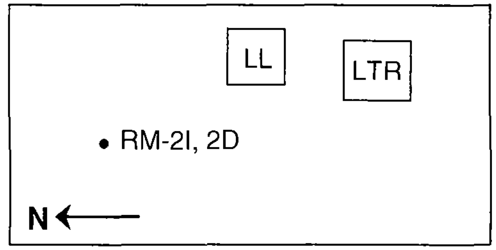
RM-002D
VOC Concentration Trends
Lemberger Landfill

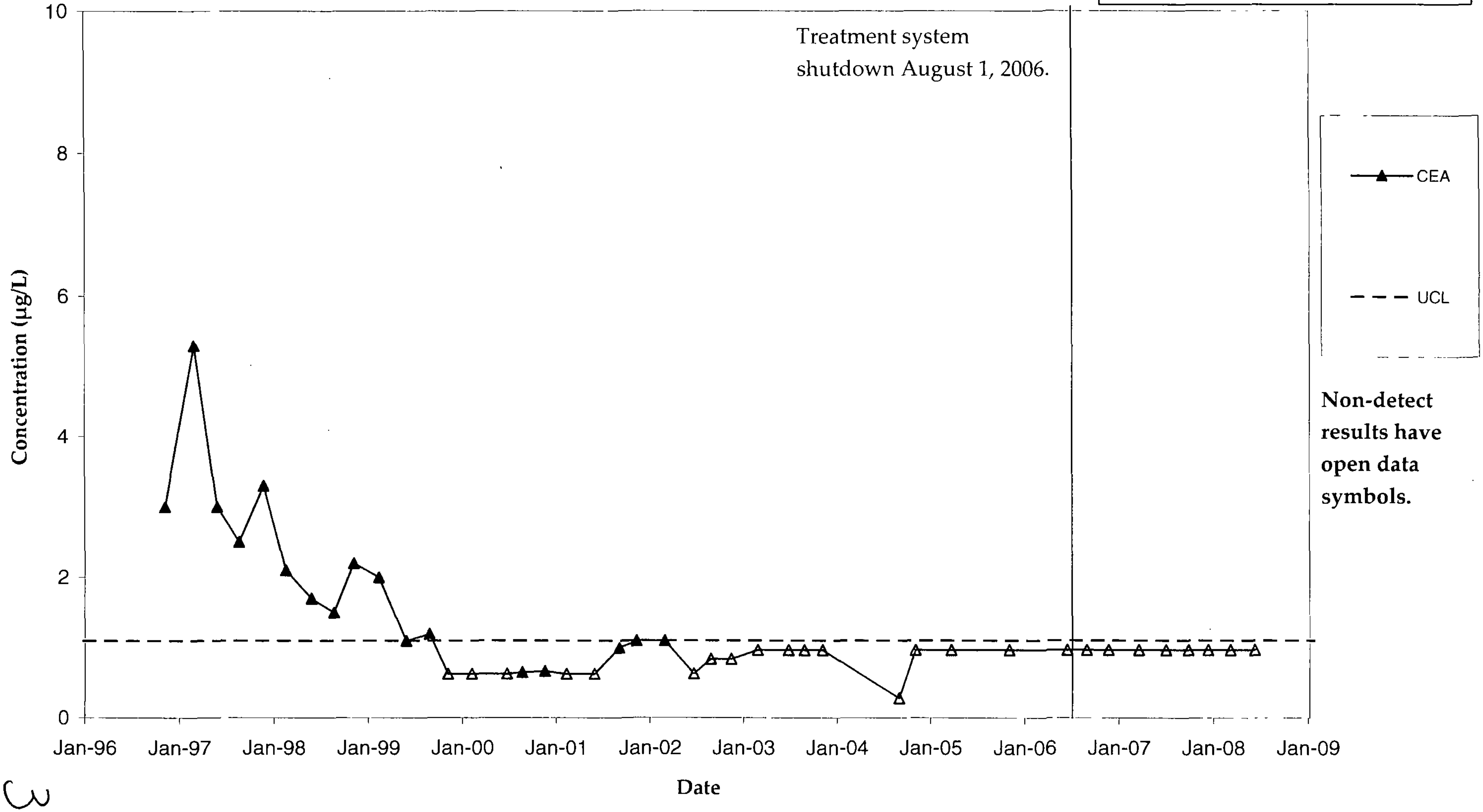




I:\WPMSN\PJT\00-03457\46\000345746-010.XLS 12/18/2008

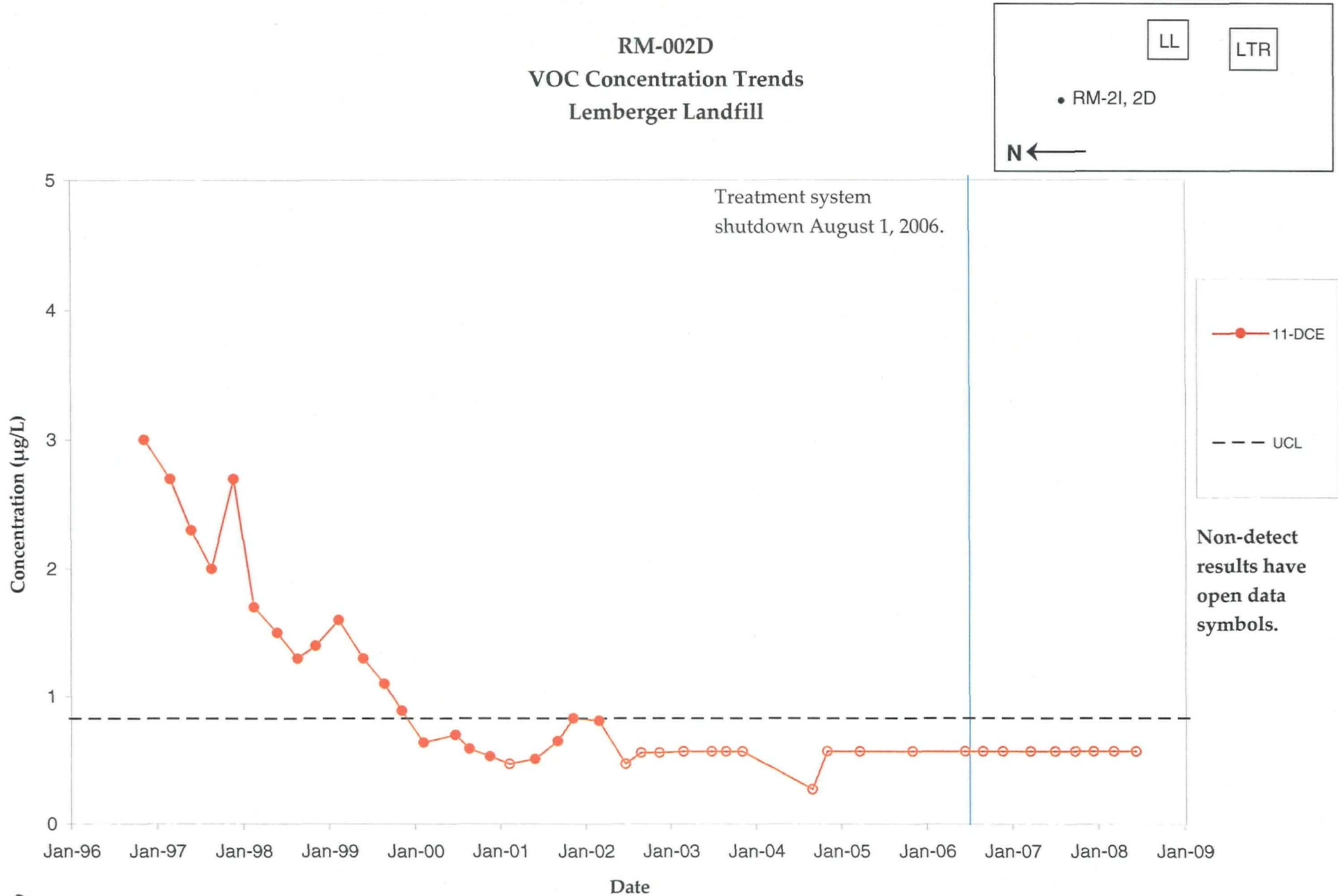
RM-002D
VOC Concentration Trends
Lemberger Landfill





3

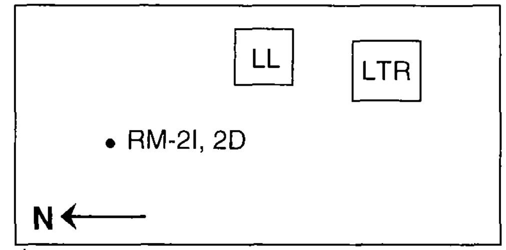
RM-002D
VOC Concentration Trends
Lemberger Landfill

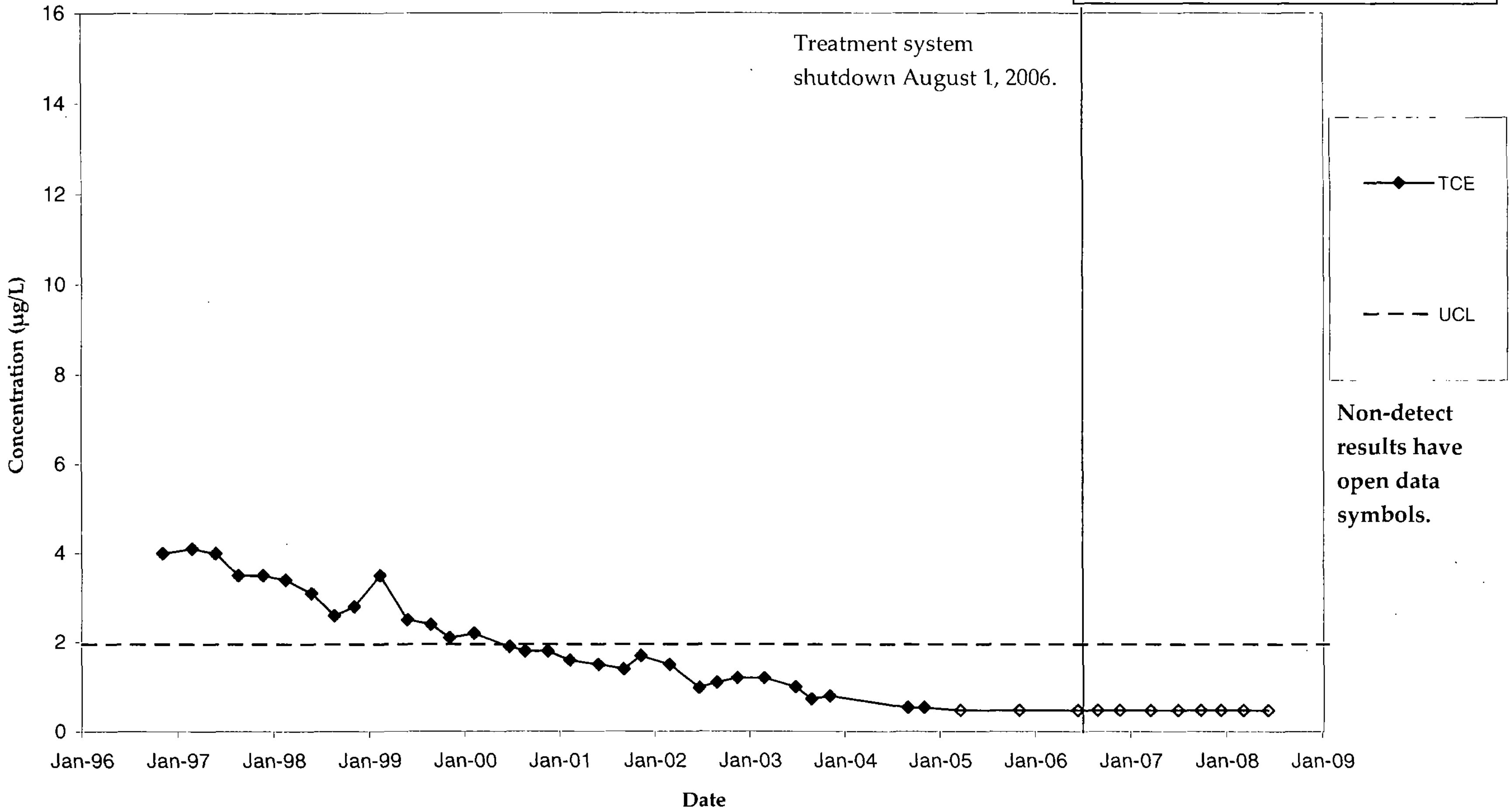


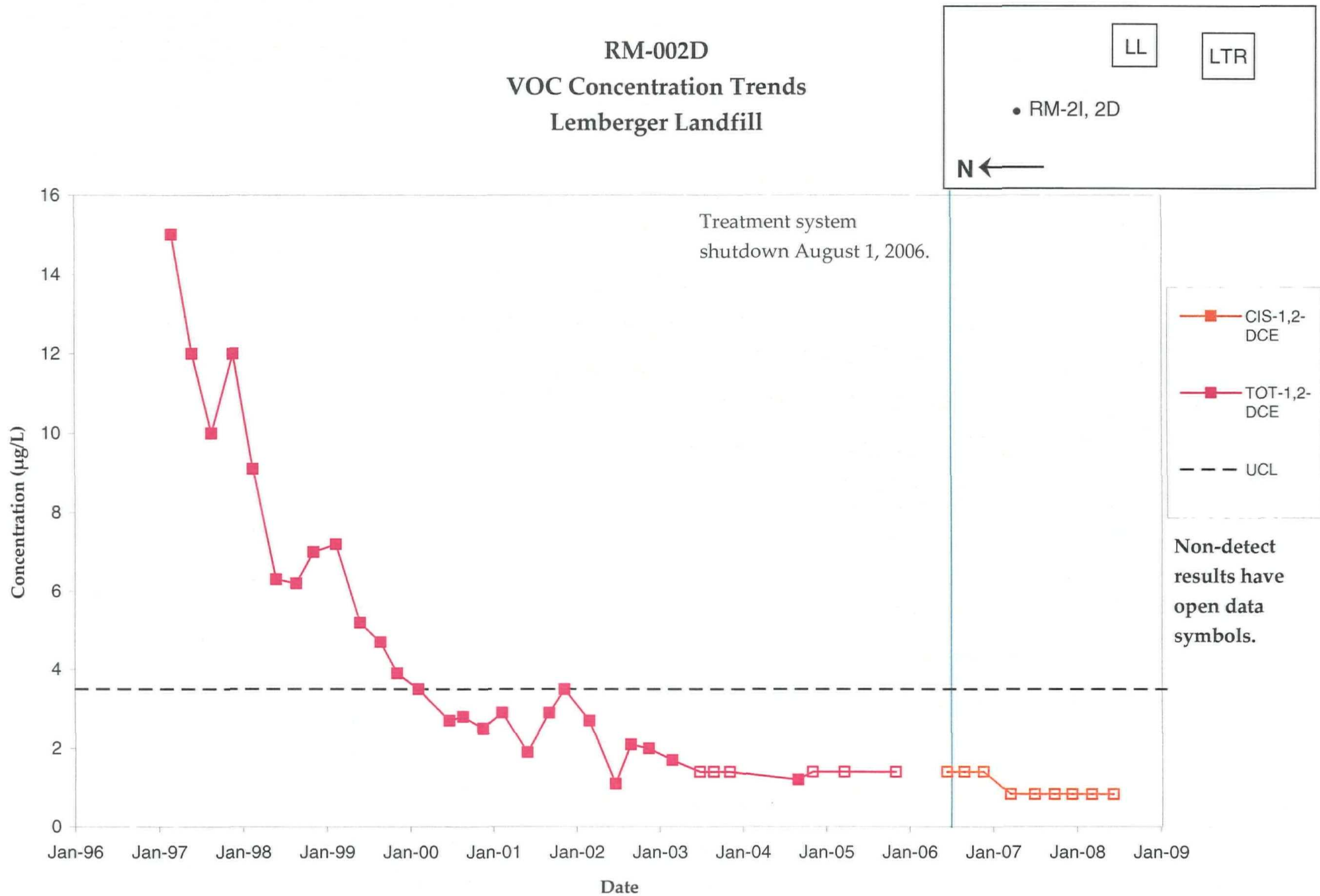
7

I:\WPMSN\PJT\00-03457\46\000345746-010.XLS 12/18/2008

RM-002D
VOC Concentration Trends
Lemberger Landfill



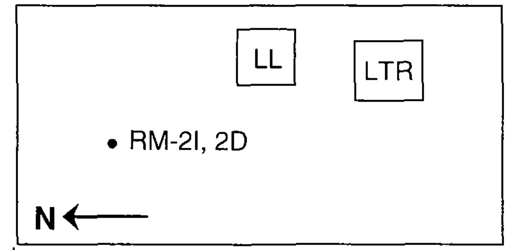


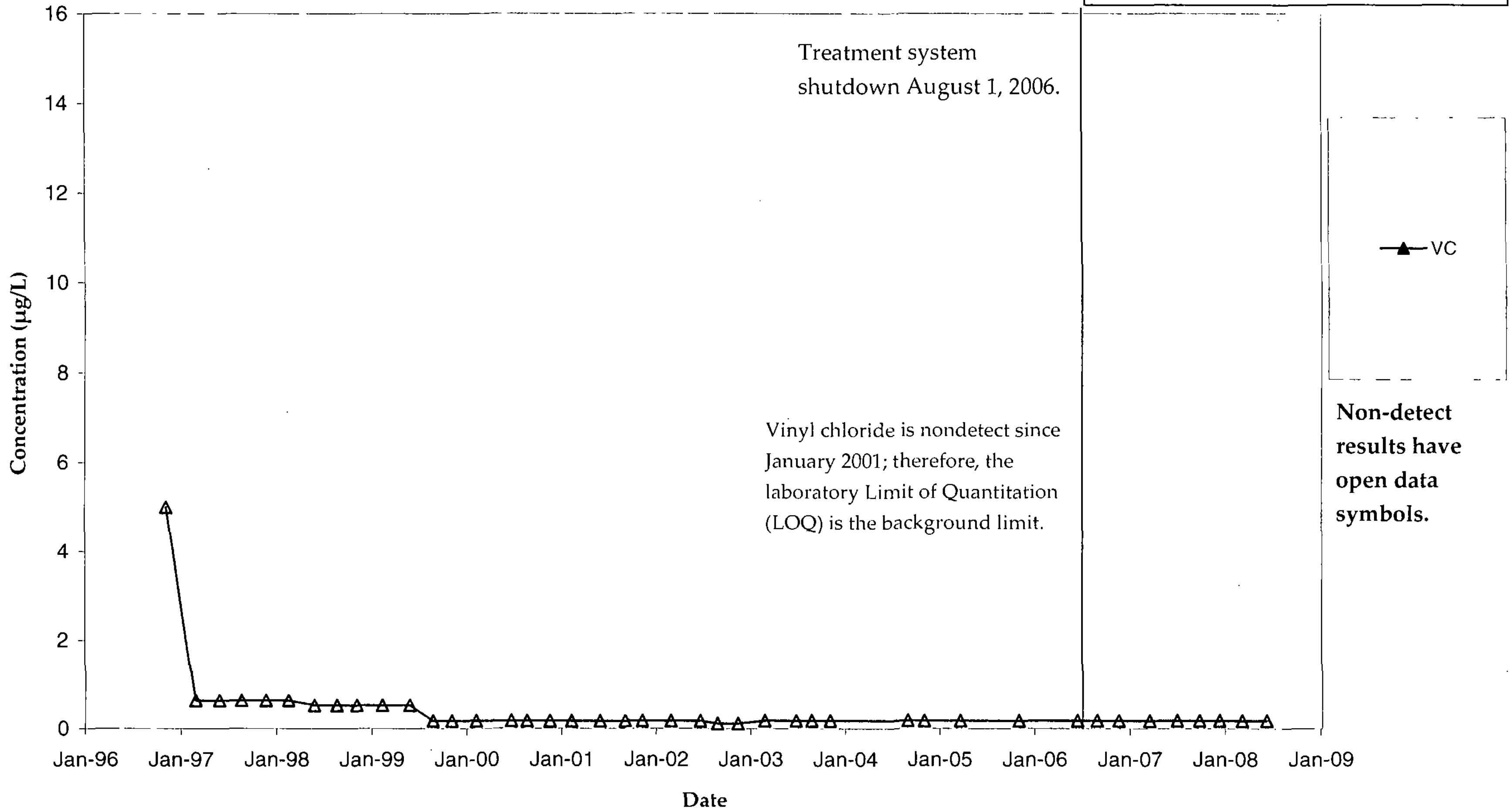


6

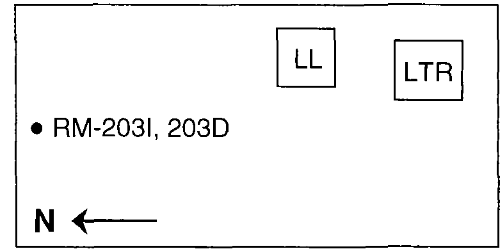
I:\WPMSN\PJT\00-03457\46\000345746-011.XLS 12/18/2008

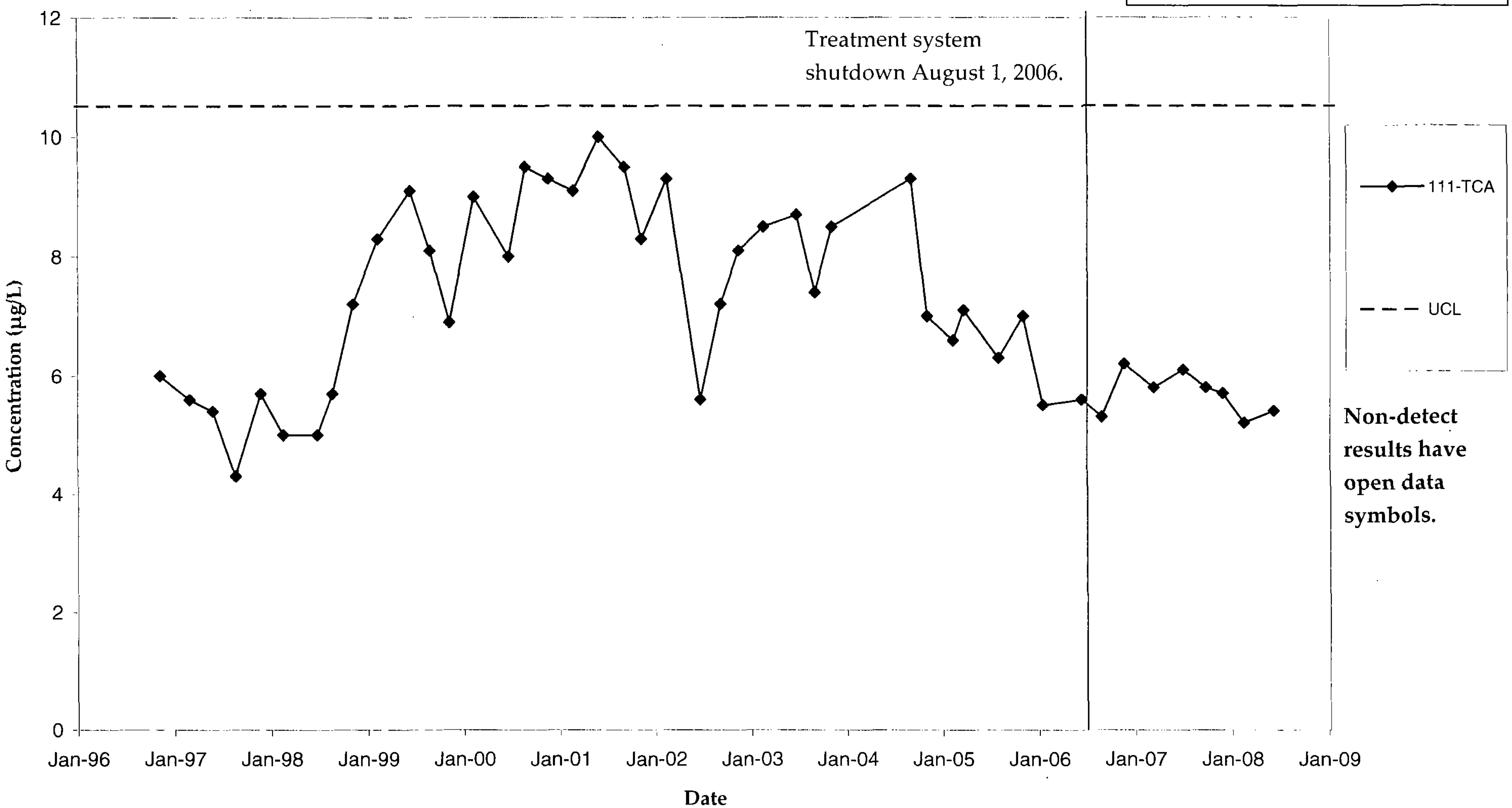
RM-002D
VOC Concentration Trends
Lemberger Landfill





RM-203D
VOC Concentration Trends
Lemberger Landfill

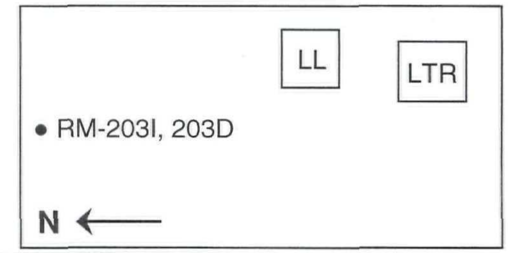


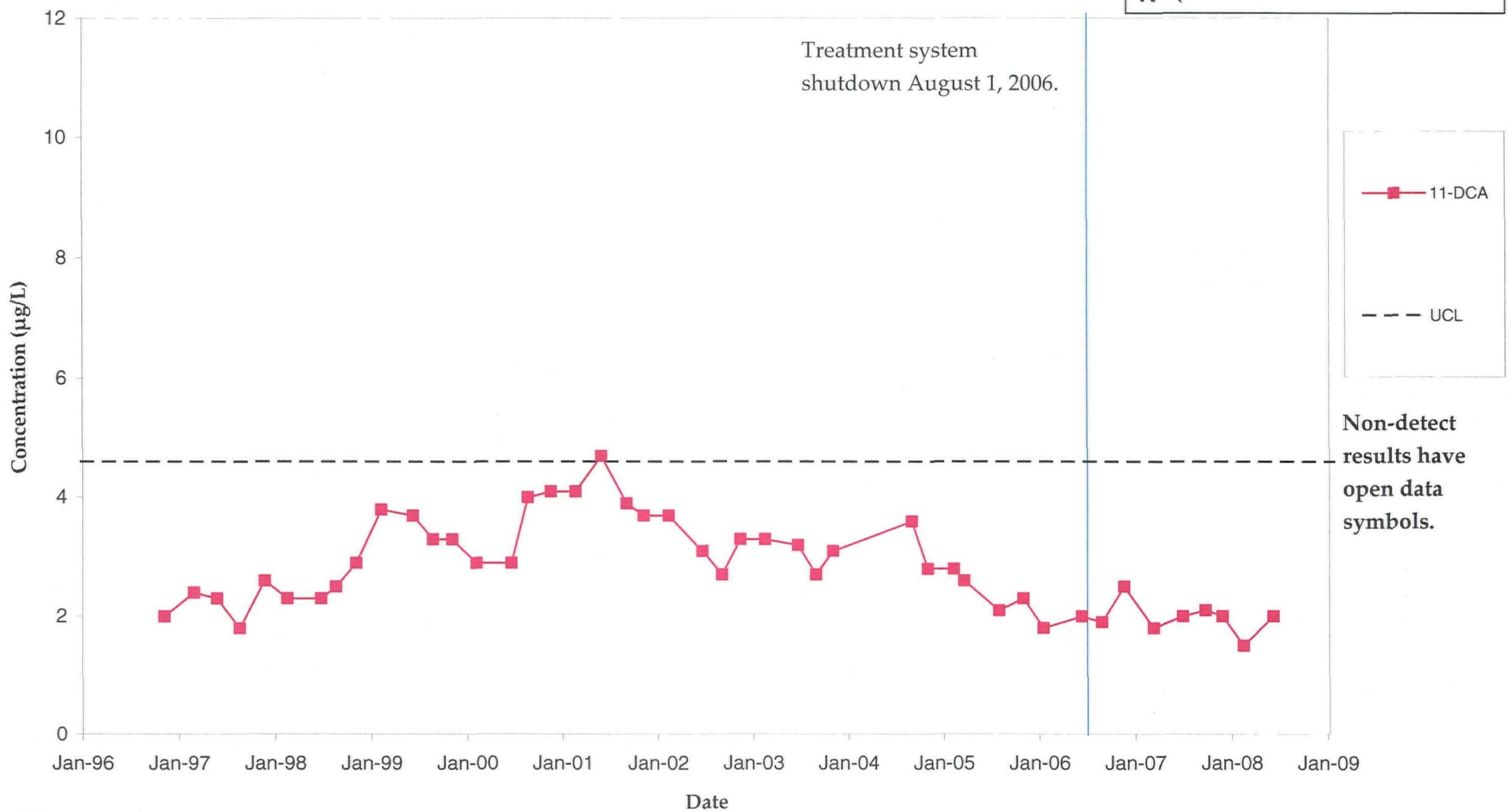


Non-detect results have open data symbols.

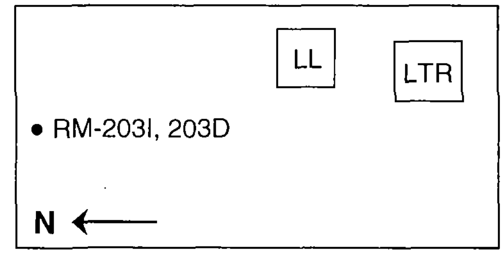
I:\WPMSN\PJT\00-03457\46\000345746-010.XLS 12/18/2008

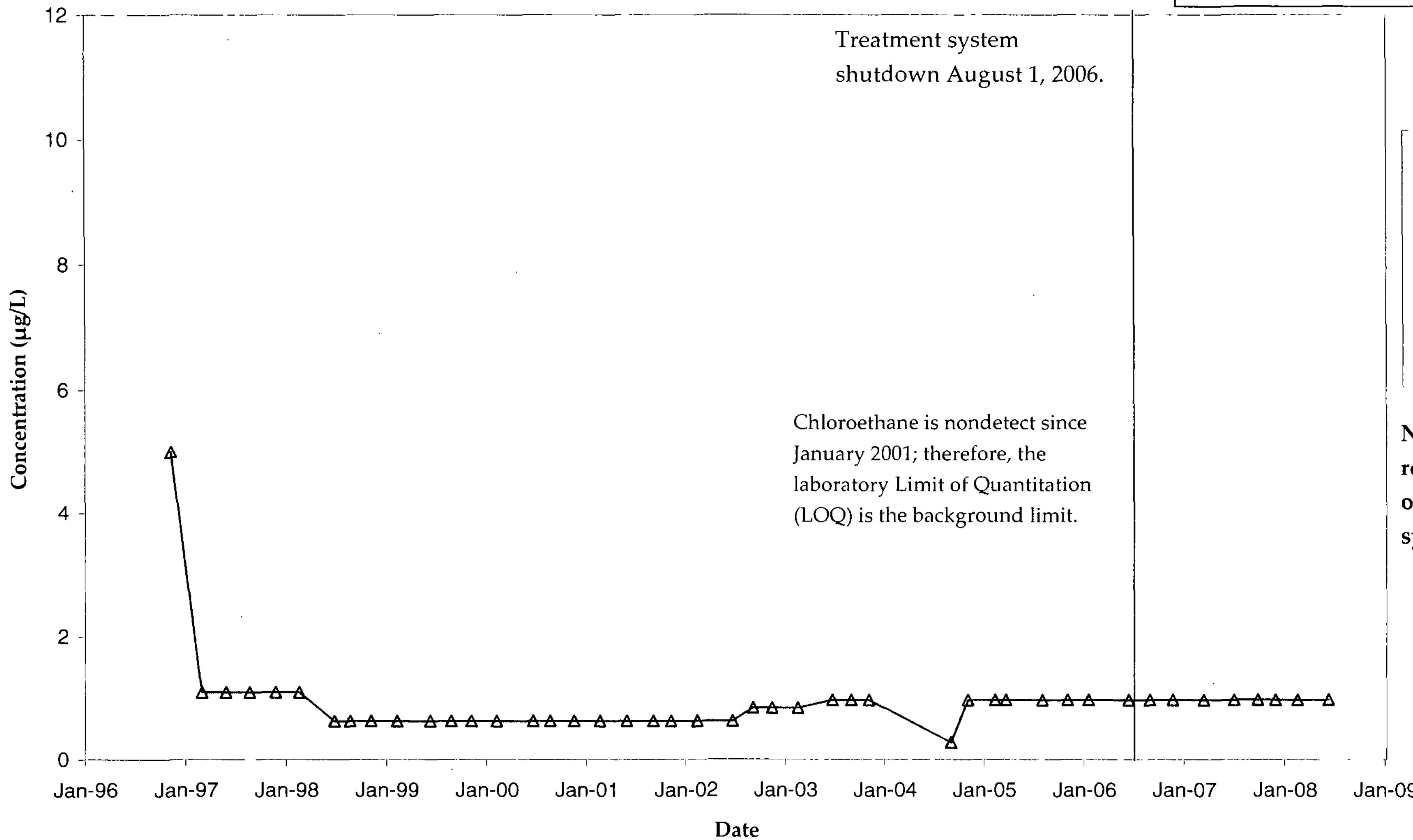
RM-203D
VOC Concentration Trends
Lemberger Landfill





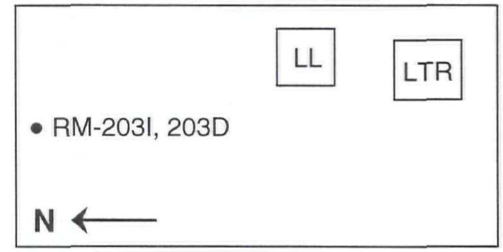
RM-203D
VOC Concentration Trends
Lemberger Landfill

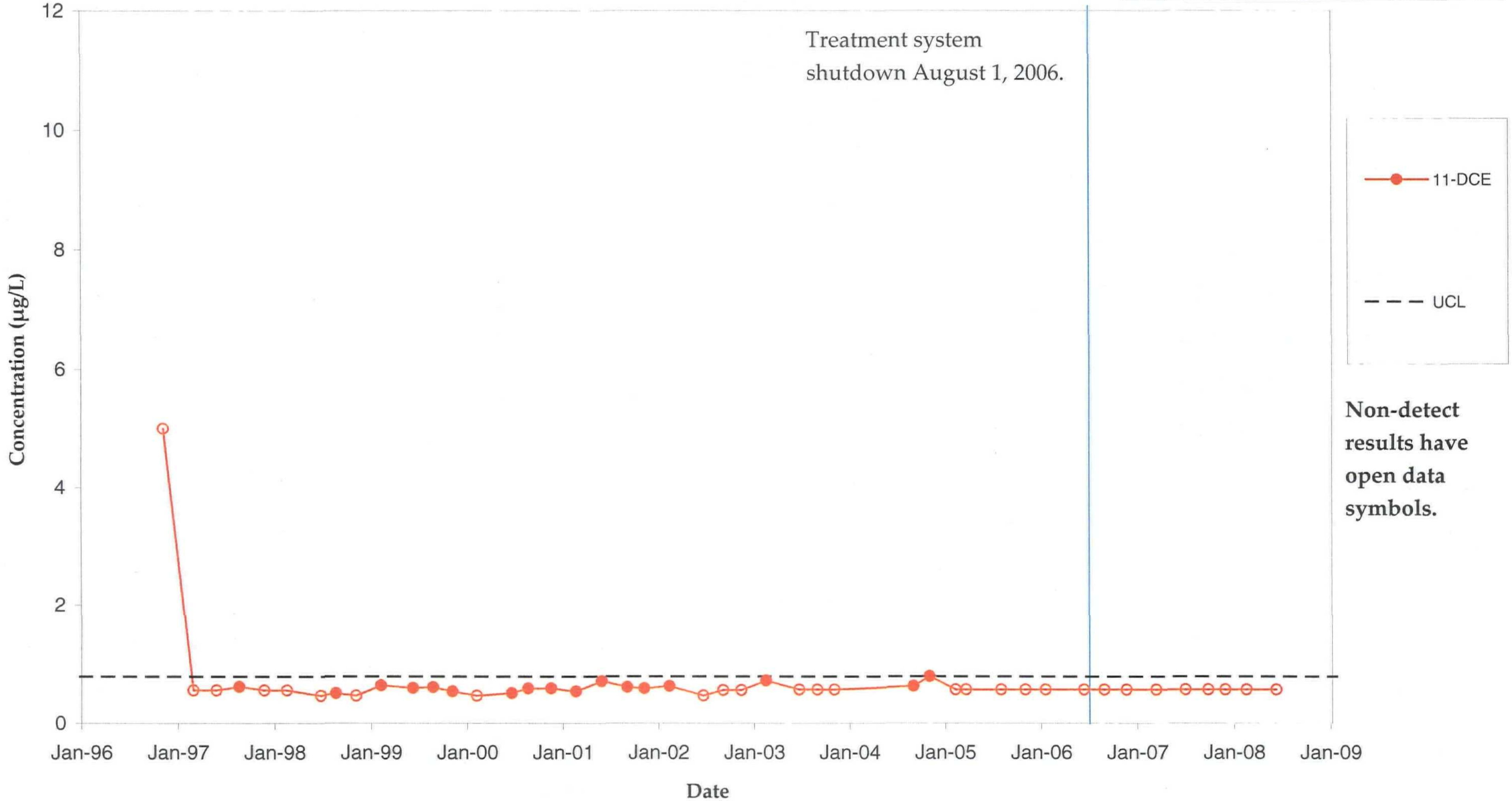




Non-detect results have open data symbols.

RM-203D
VOC Concentration Trends
Lemberger Landfill





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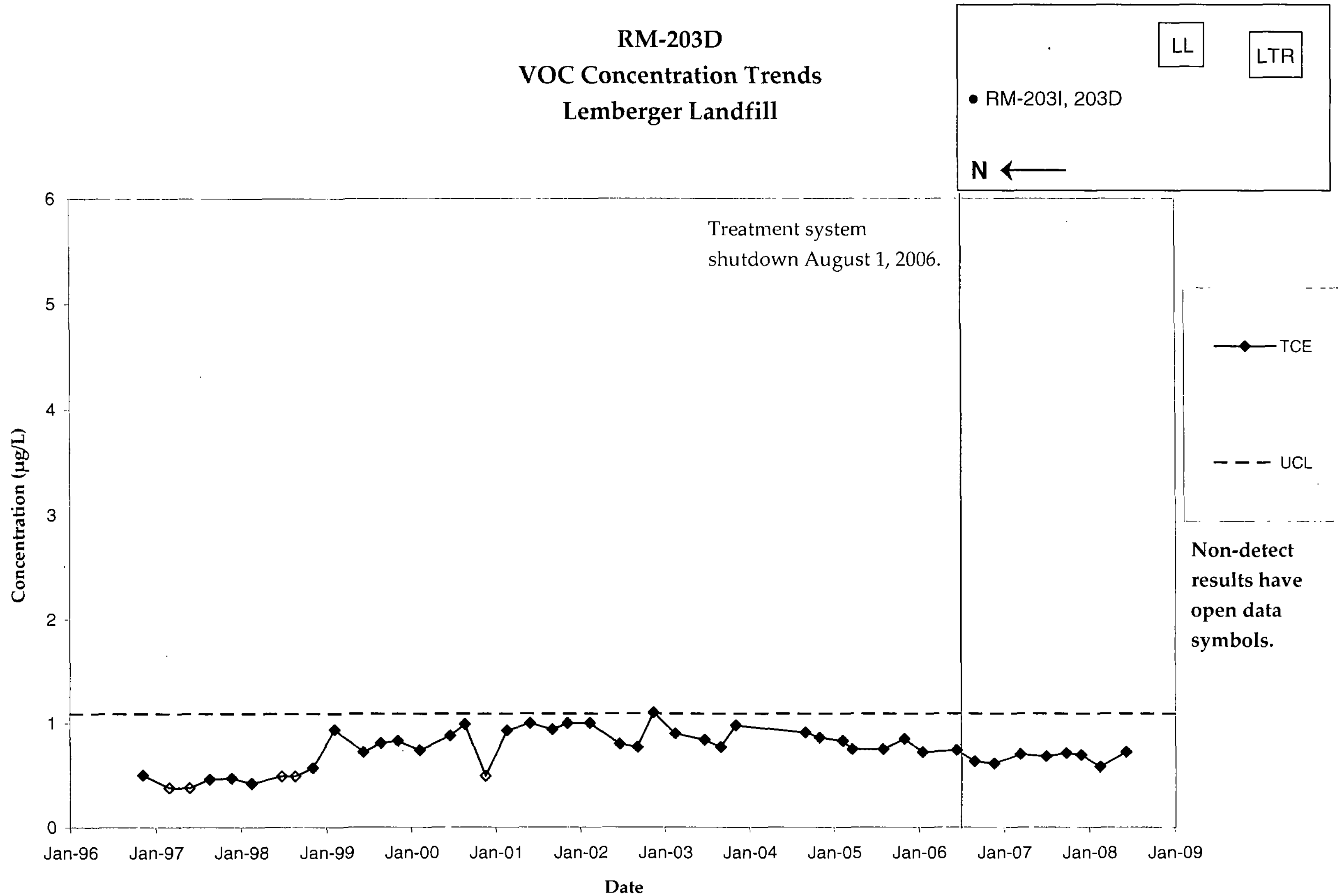
RM-203D
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

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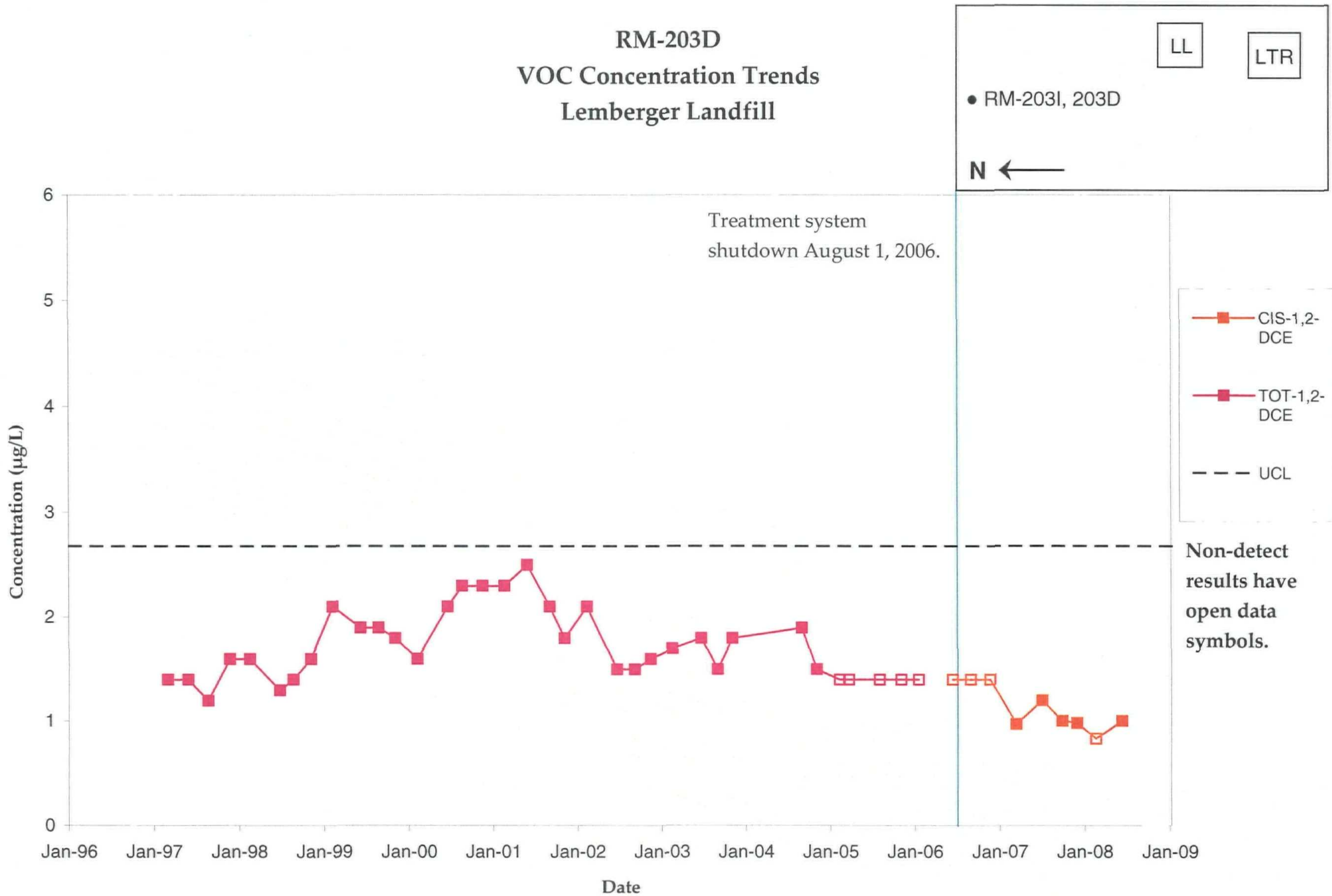
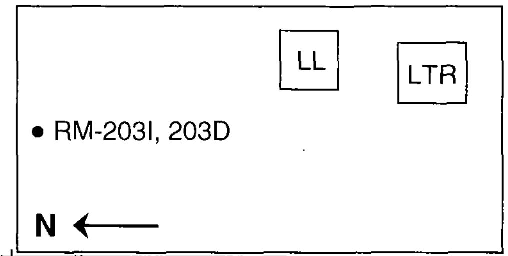
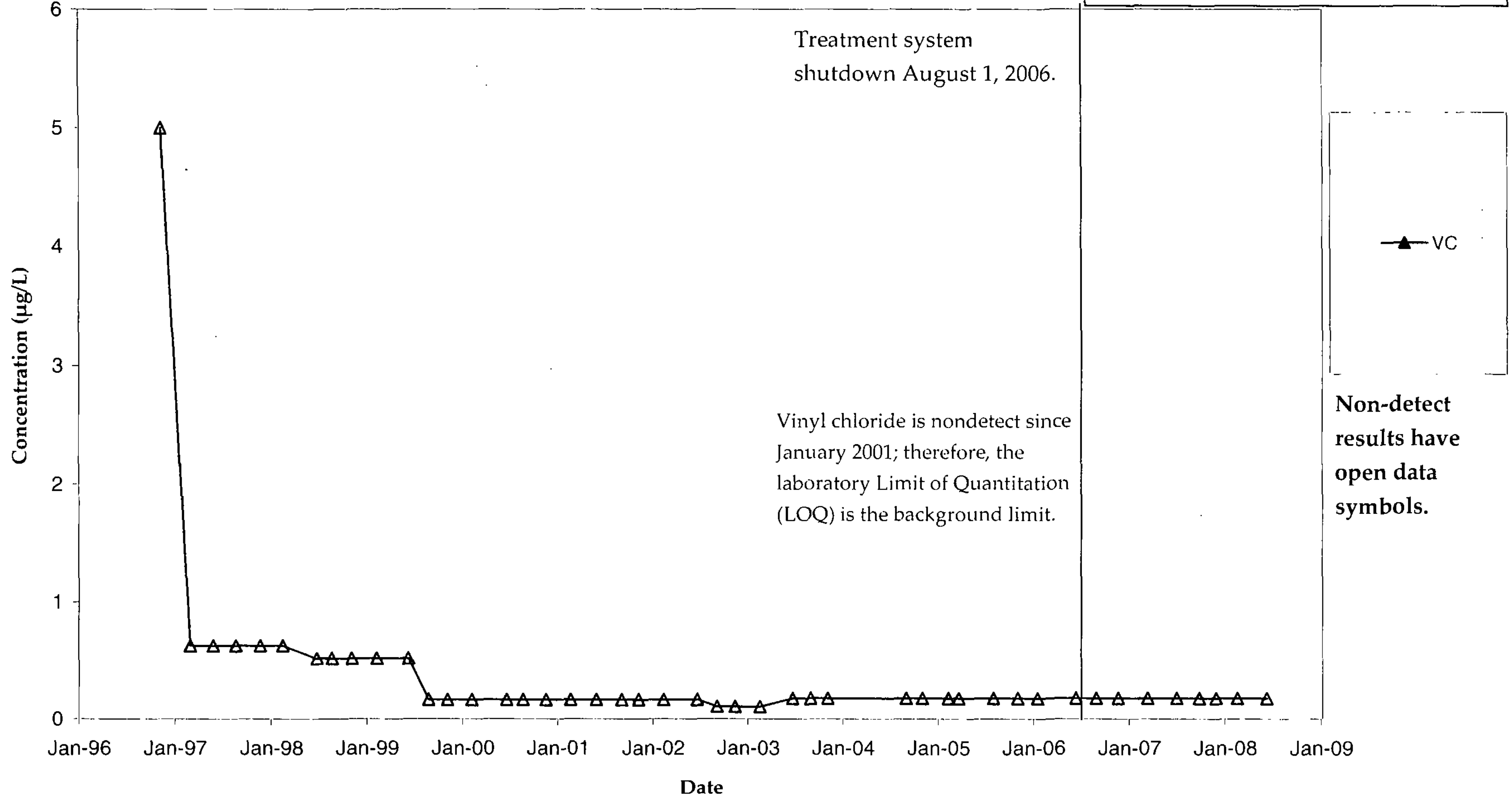
RM-203D
VOC Concentration Trends
Lemberger Landfill



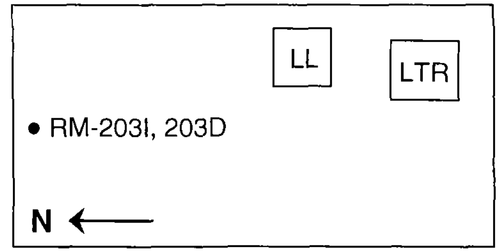
13

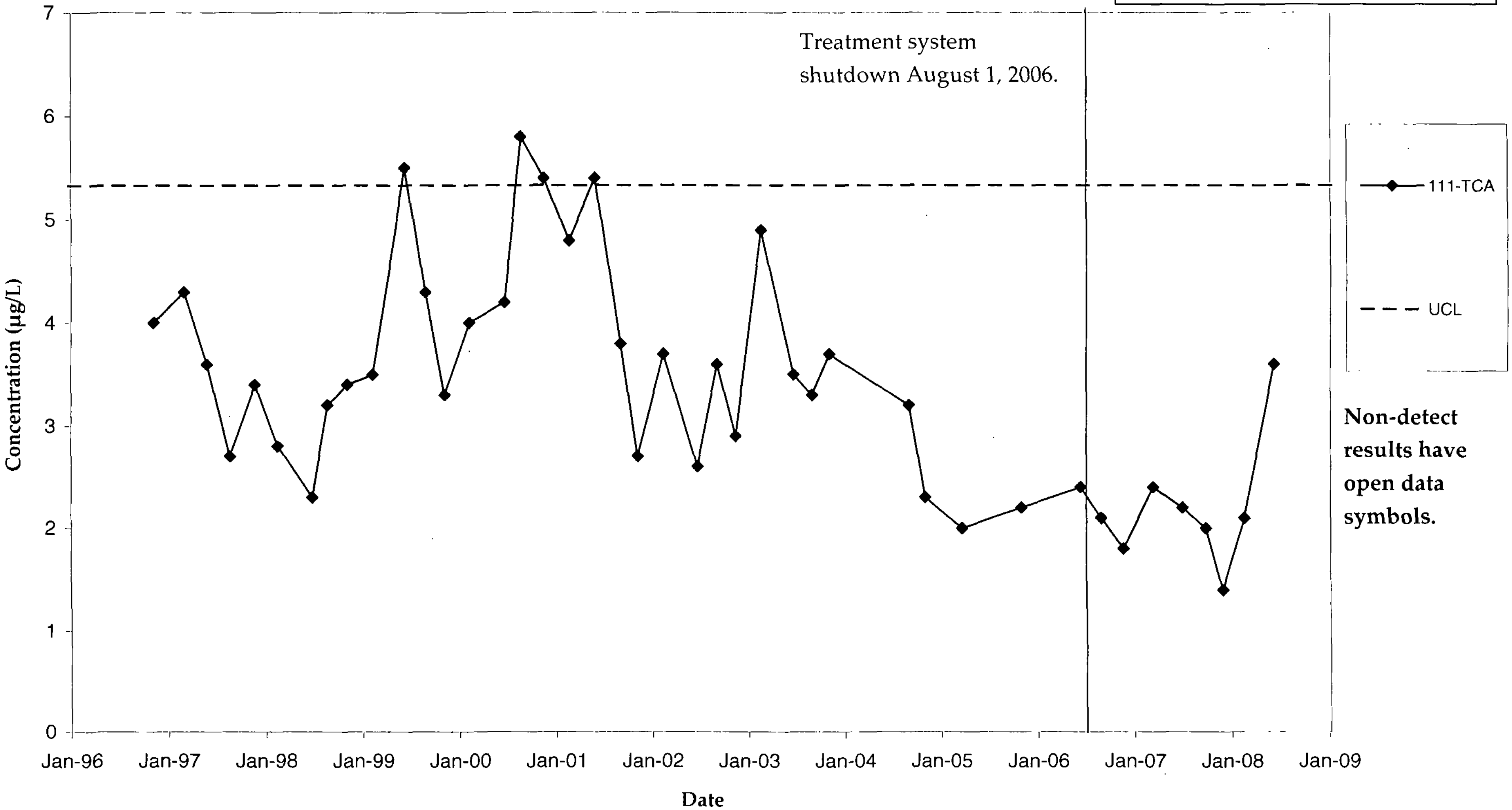
RM-203D
VOC Concentration Trends
Lemberger Landfill





RM-203I
VOC Concentration Trends
Lemberger Landfill





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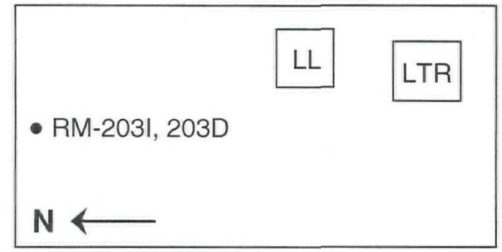
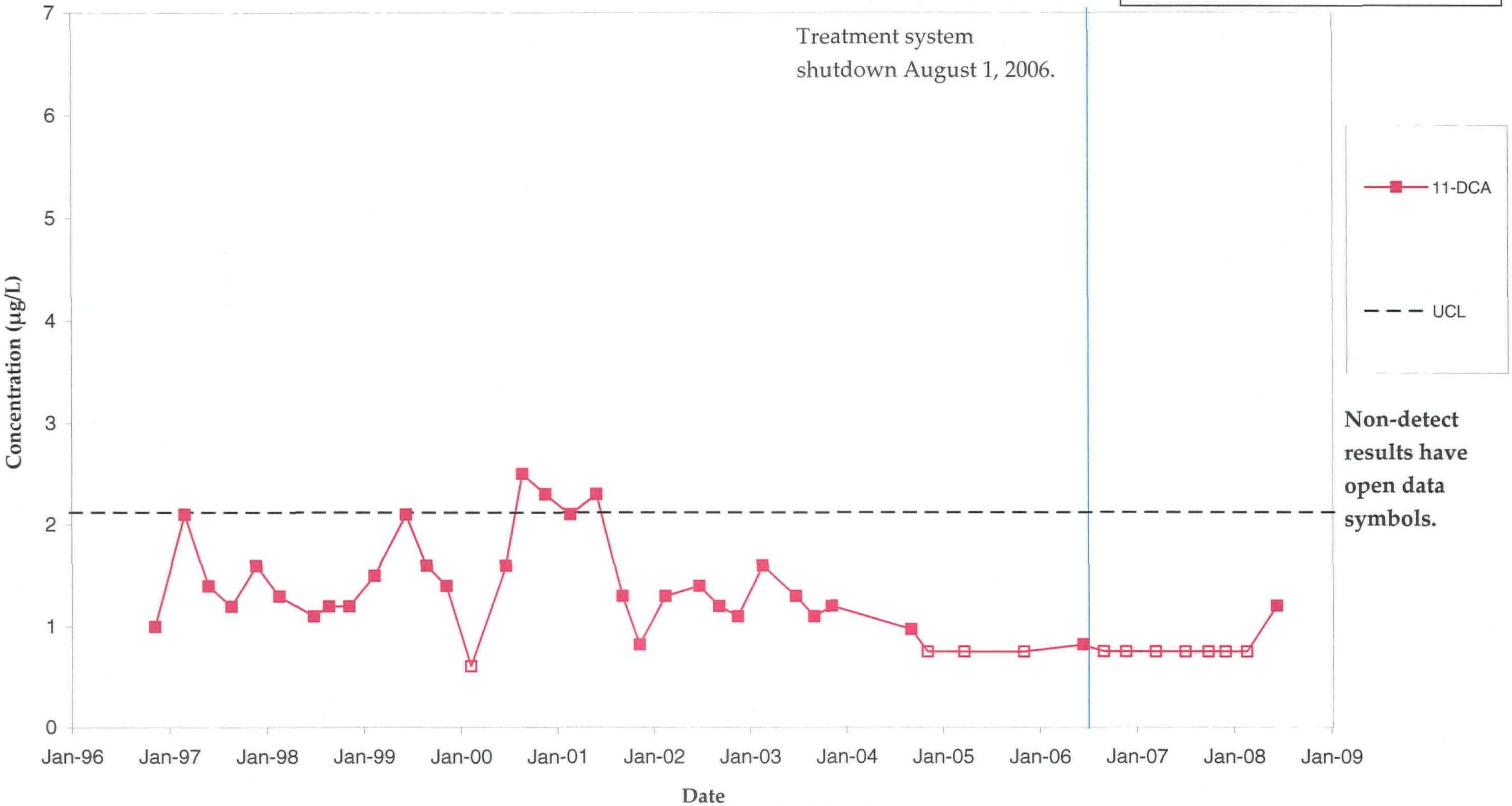
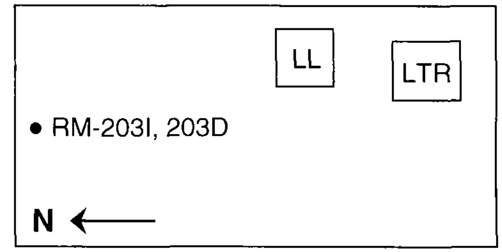
RM-203I
VOC Concentration Trends
Lemberger Landfill

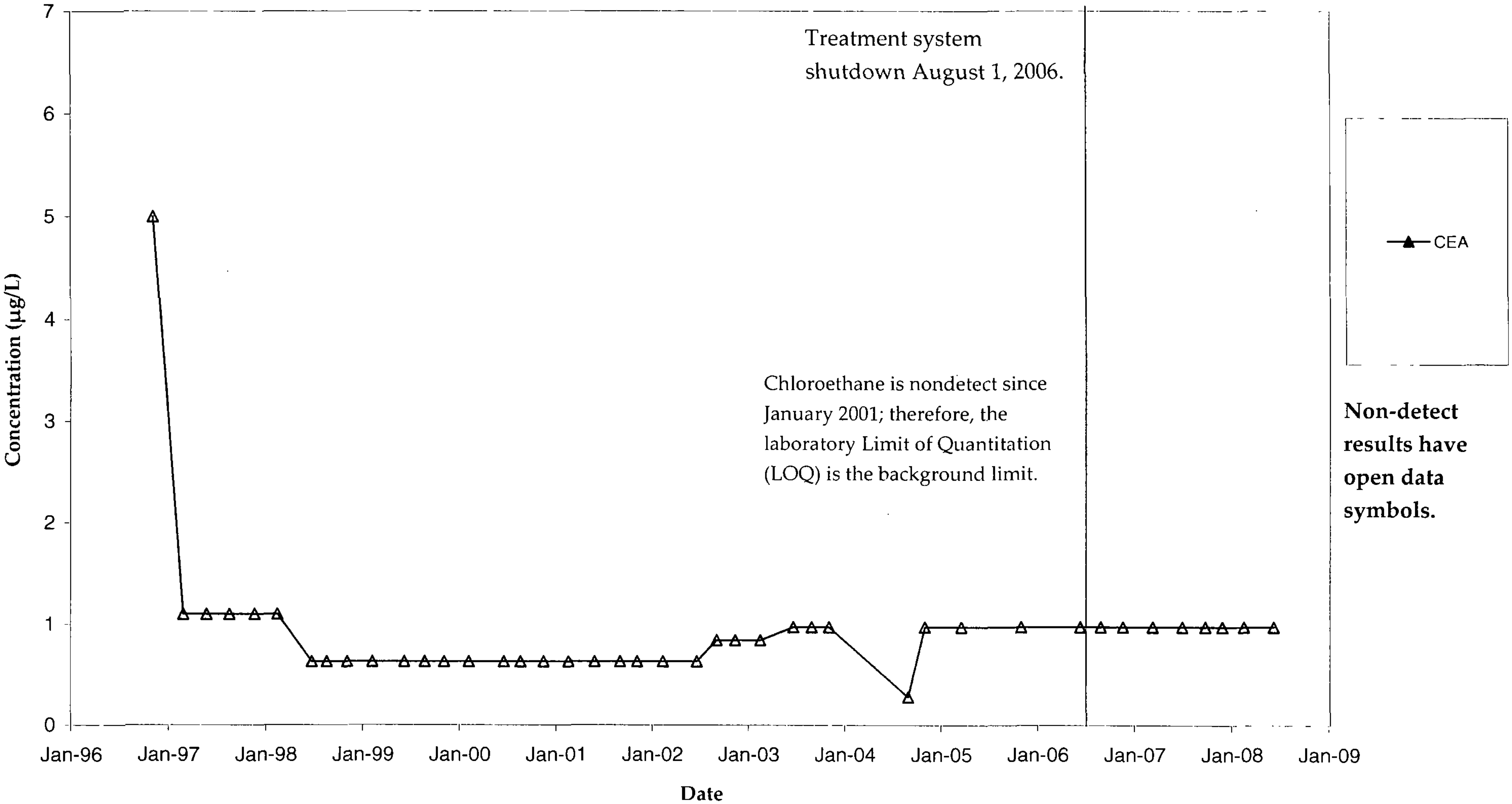




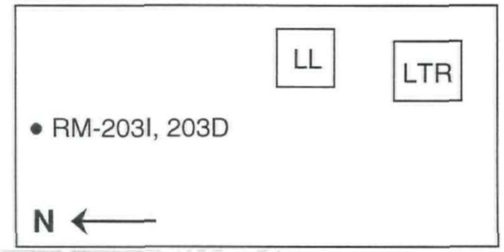
16

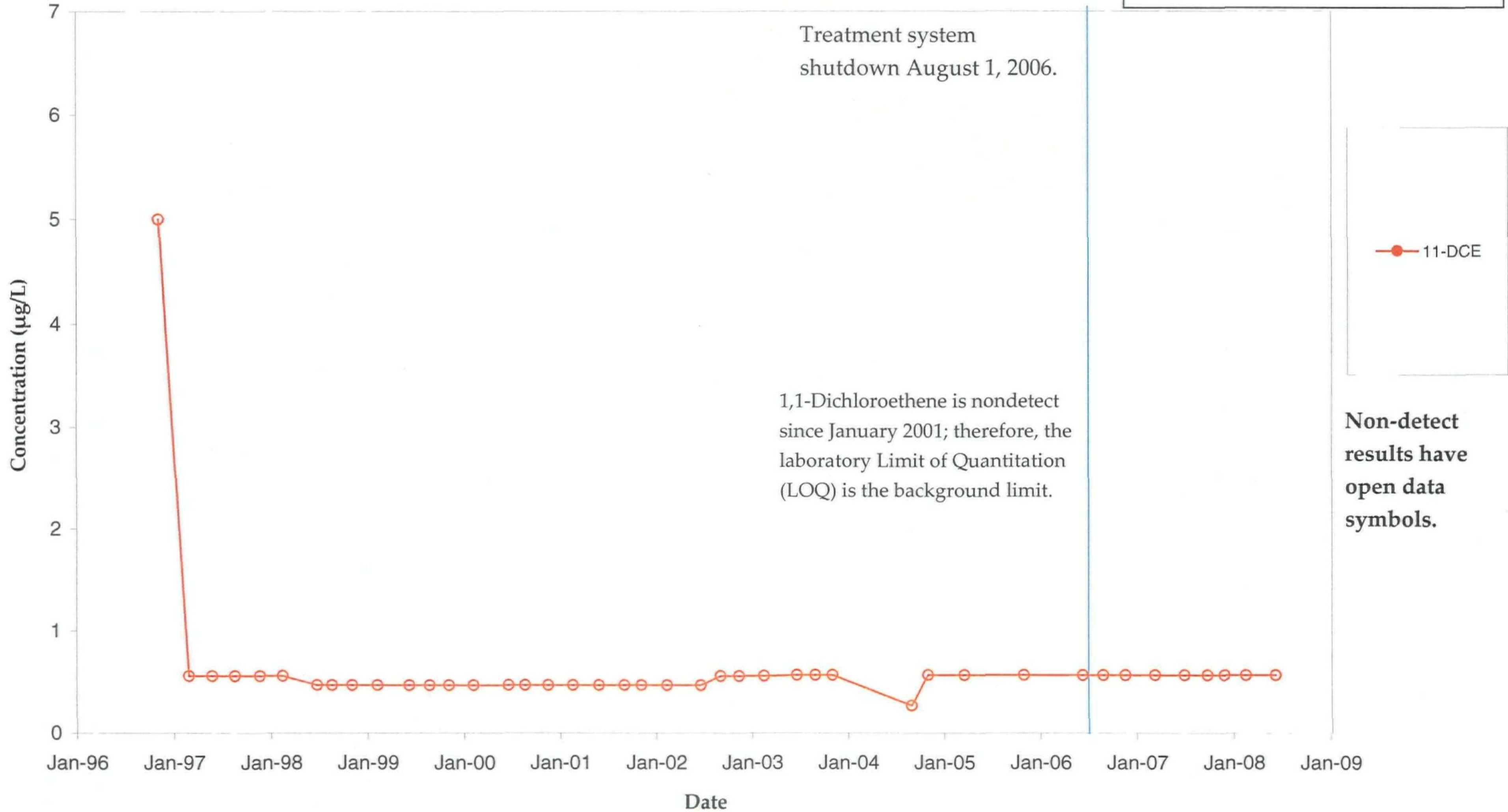
RM-203I
VOC Concentration Trends
Lemberger Landfill





RM-203I
VOC Concentration Trends
Lemberger Landfill





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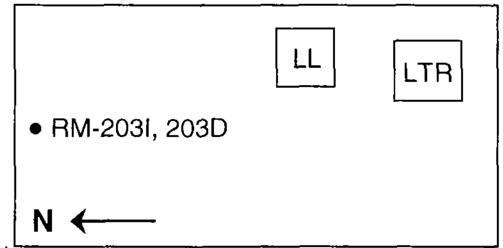
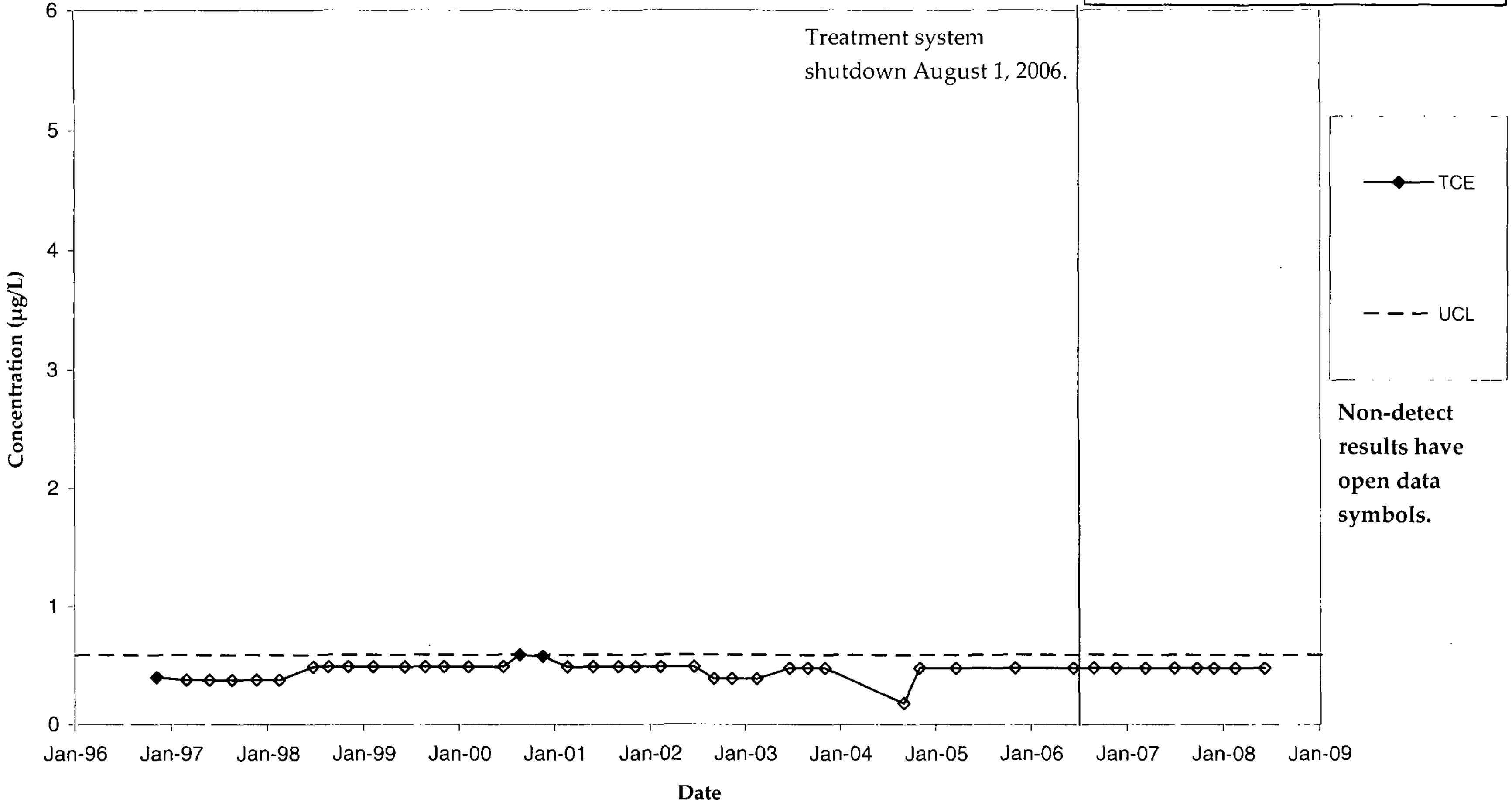
RM-203I
VOC Concentration Trends
Lemberger Landfill





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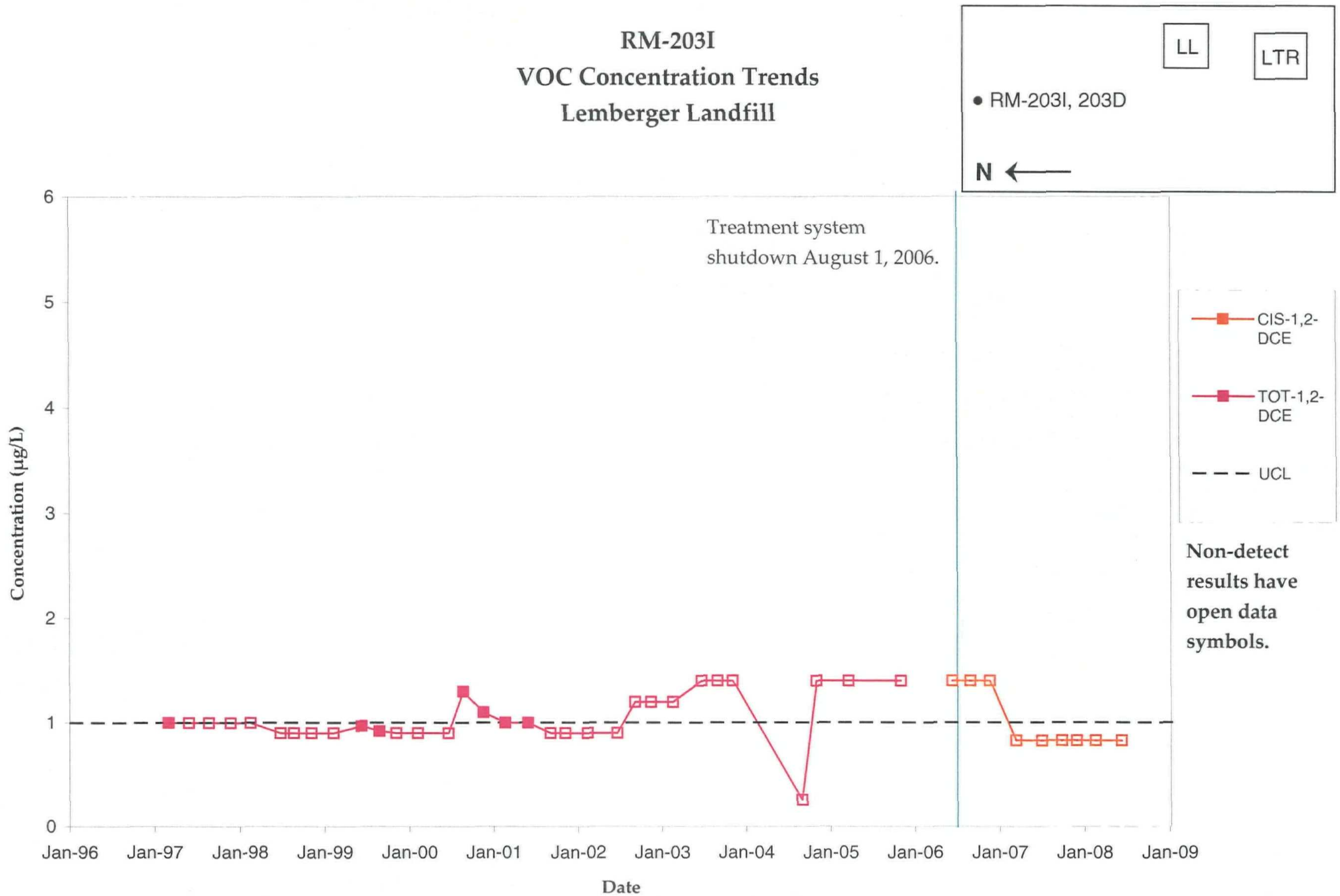

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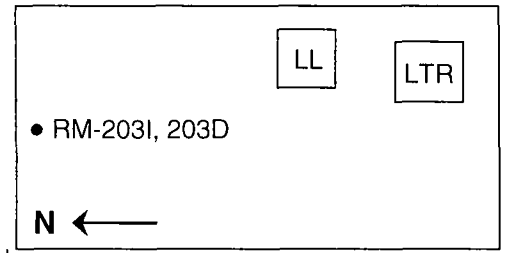
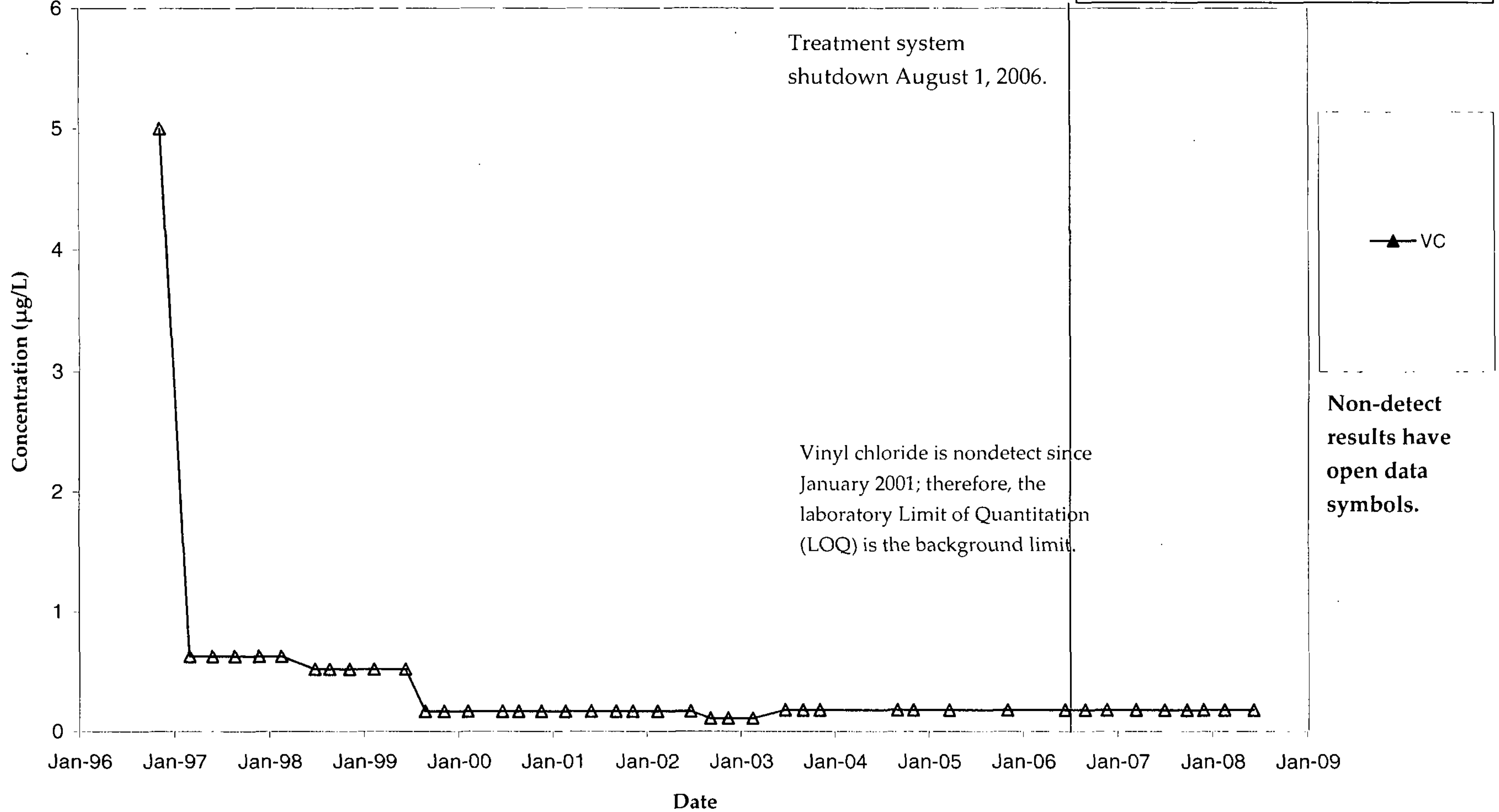
RM-203I
VOC Concentration Trends
Lemberger Landfill





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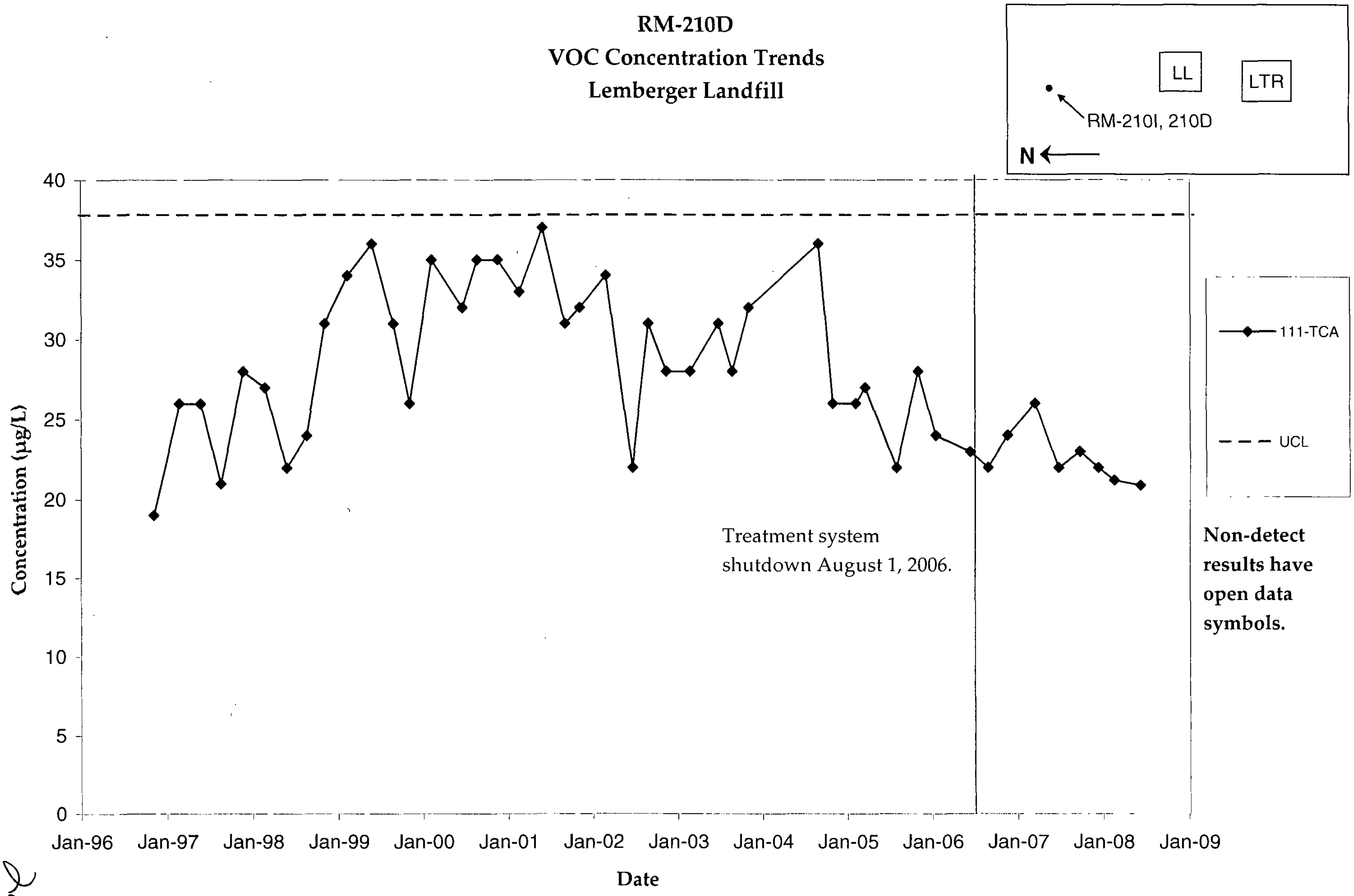

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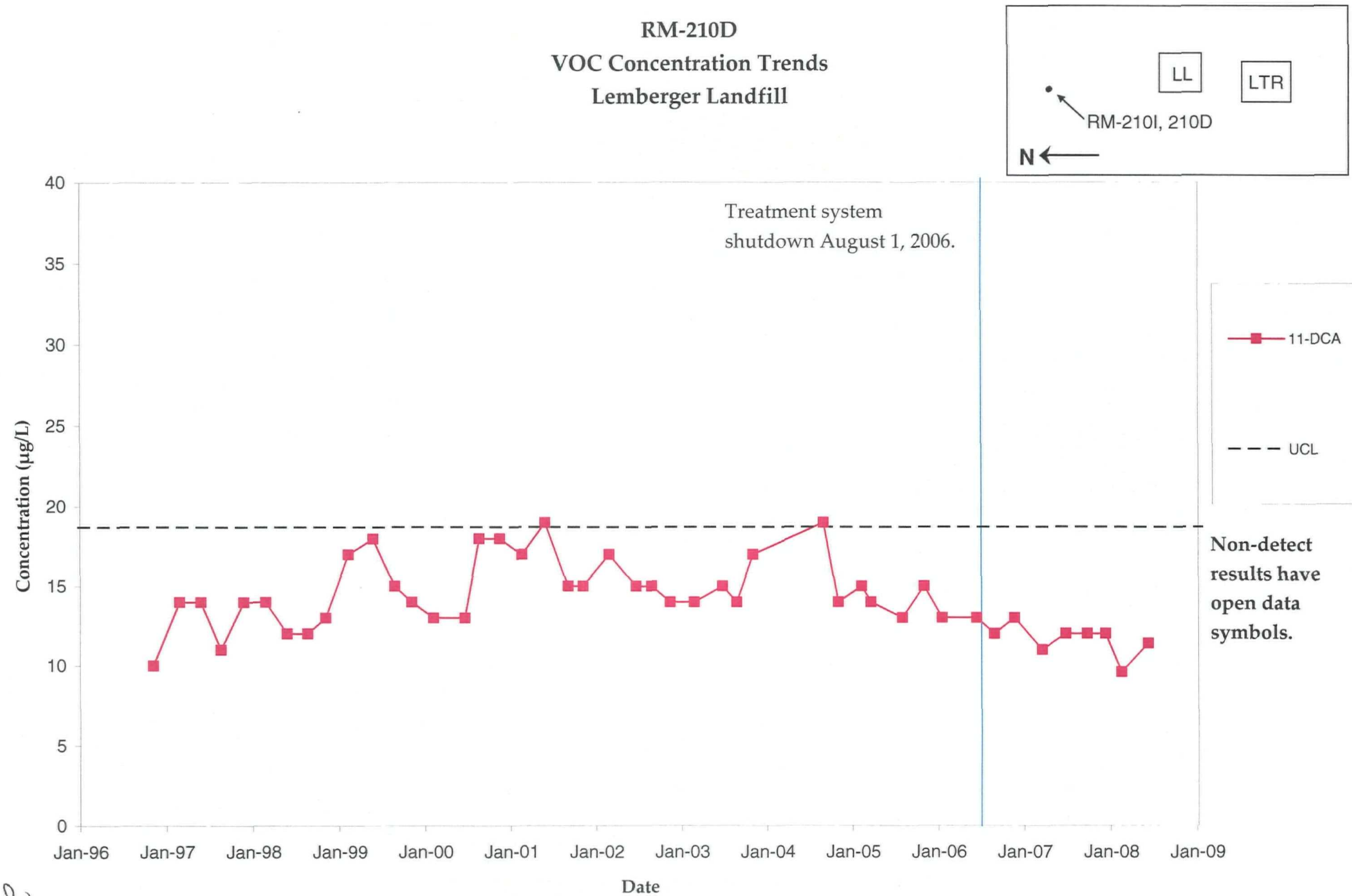

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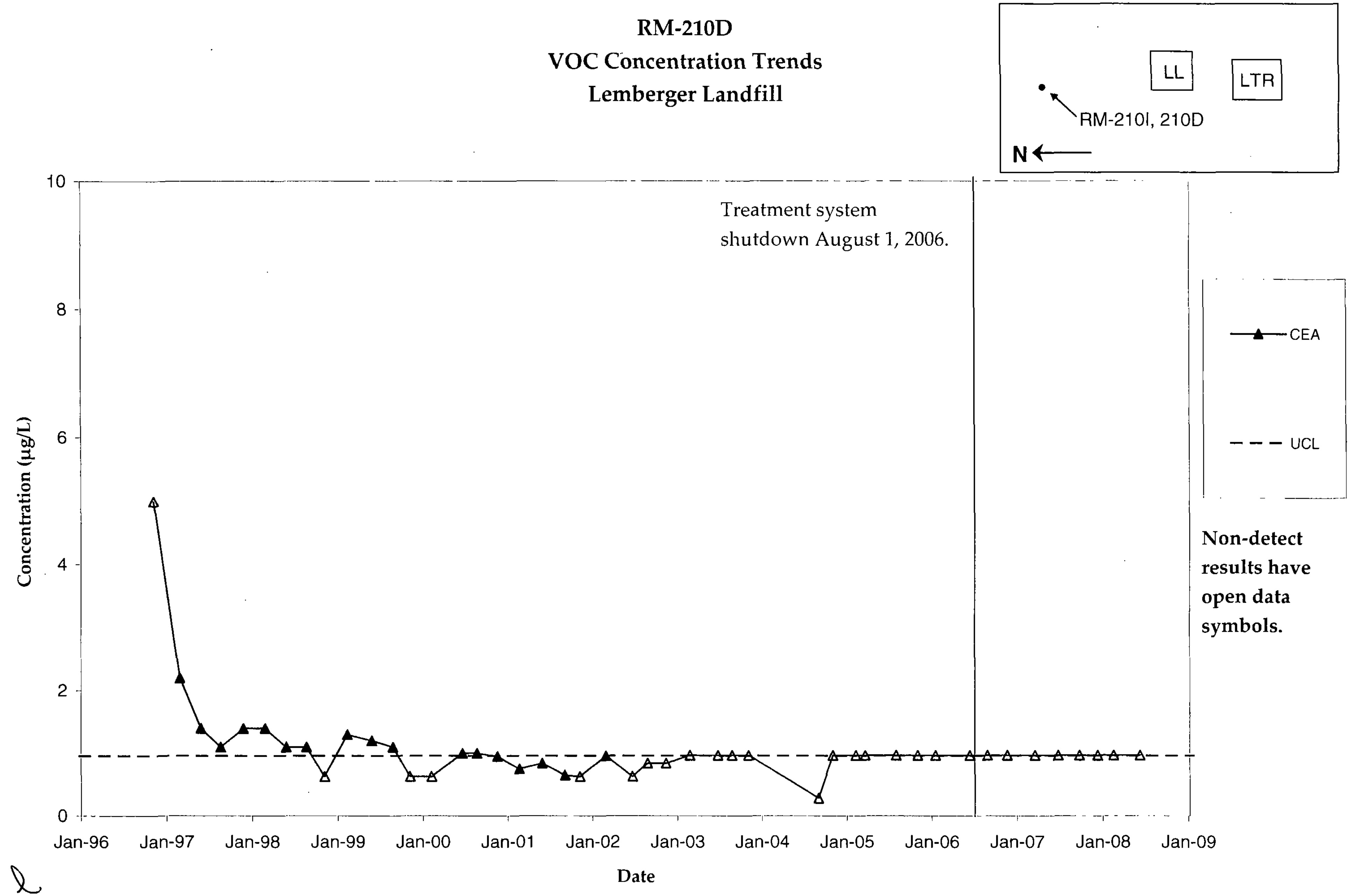
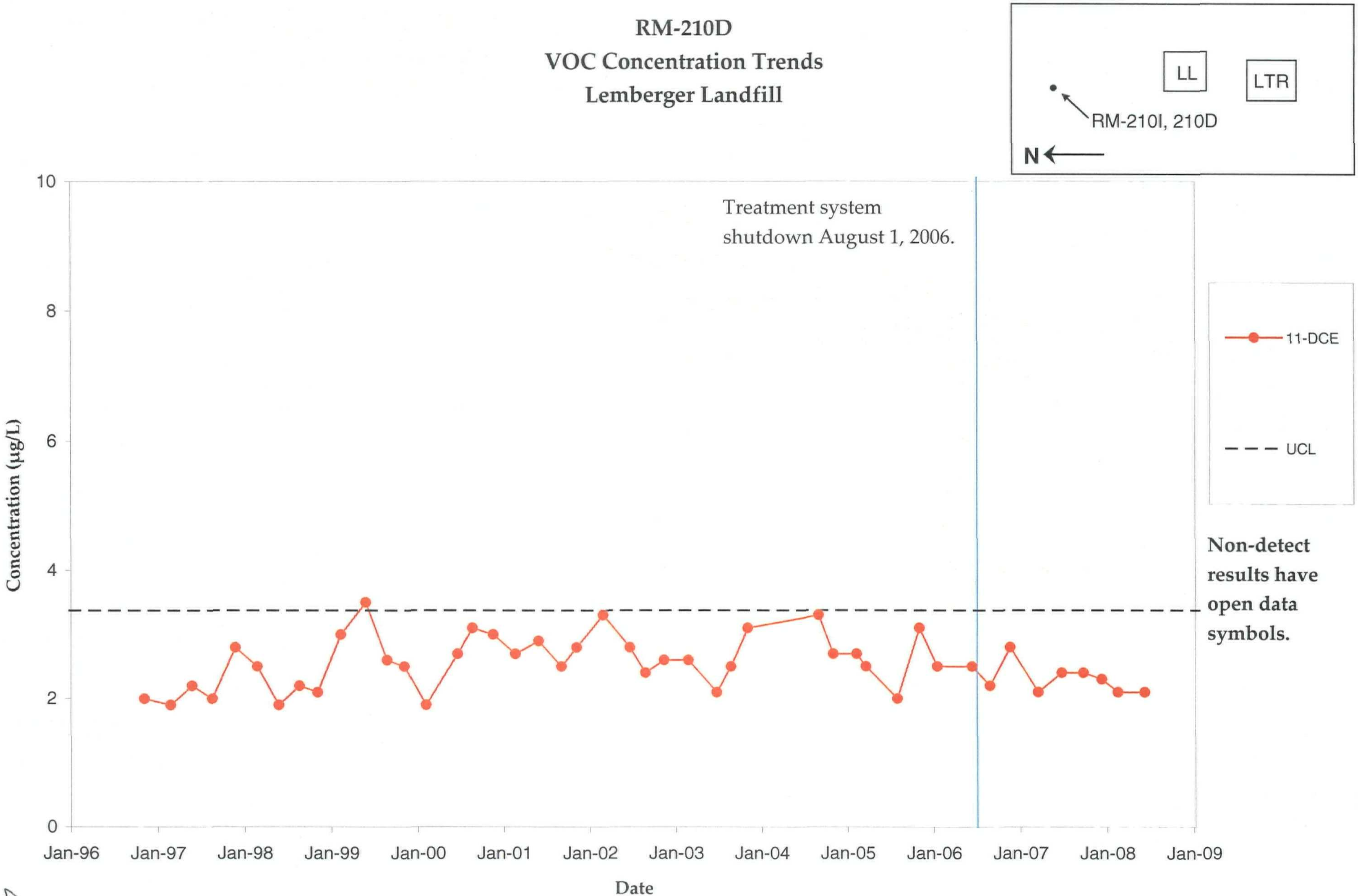

RM-210D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-210I, 210D
N
Treatment system
shutdown August 1, 2006.
CEA
UCL
Non-detect
results have
open data
symbols.
Concentration (µg/L)
0
2
4
6
8
10
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Date

RM-210D
VOC Concentration Trends
Lemberger Landfill



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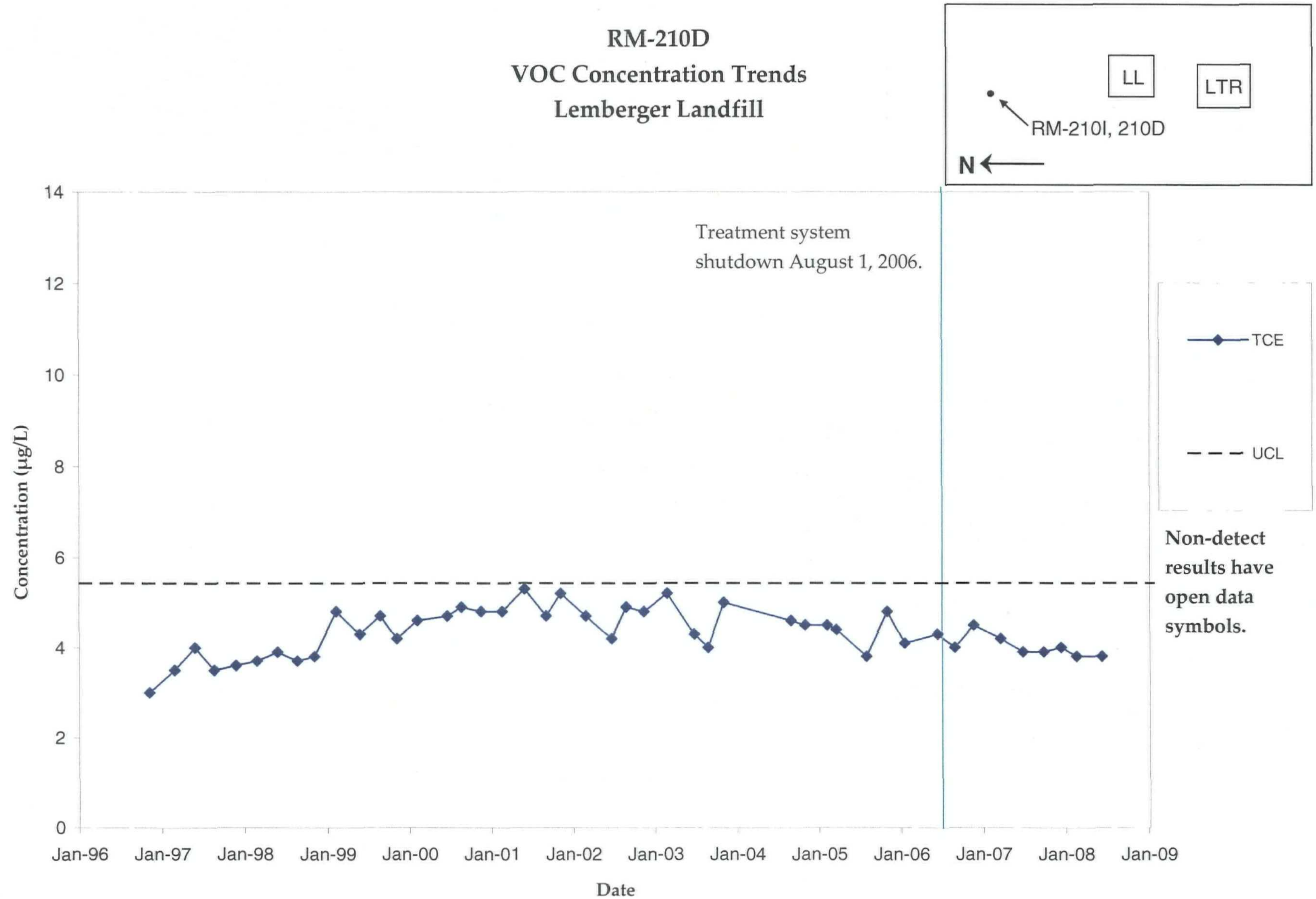

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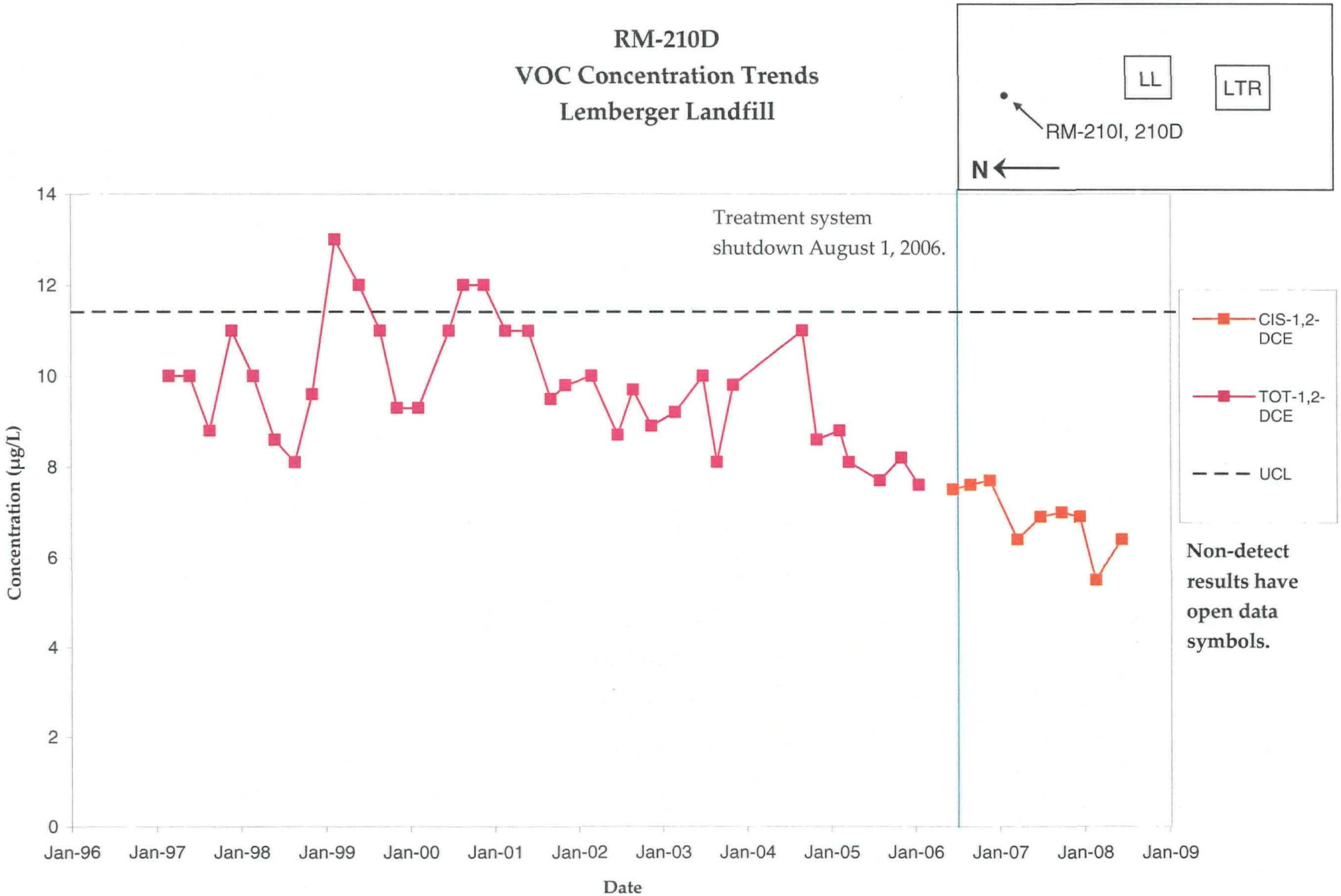

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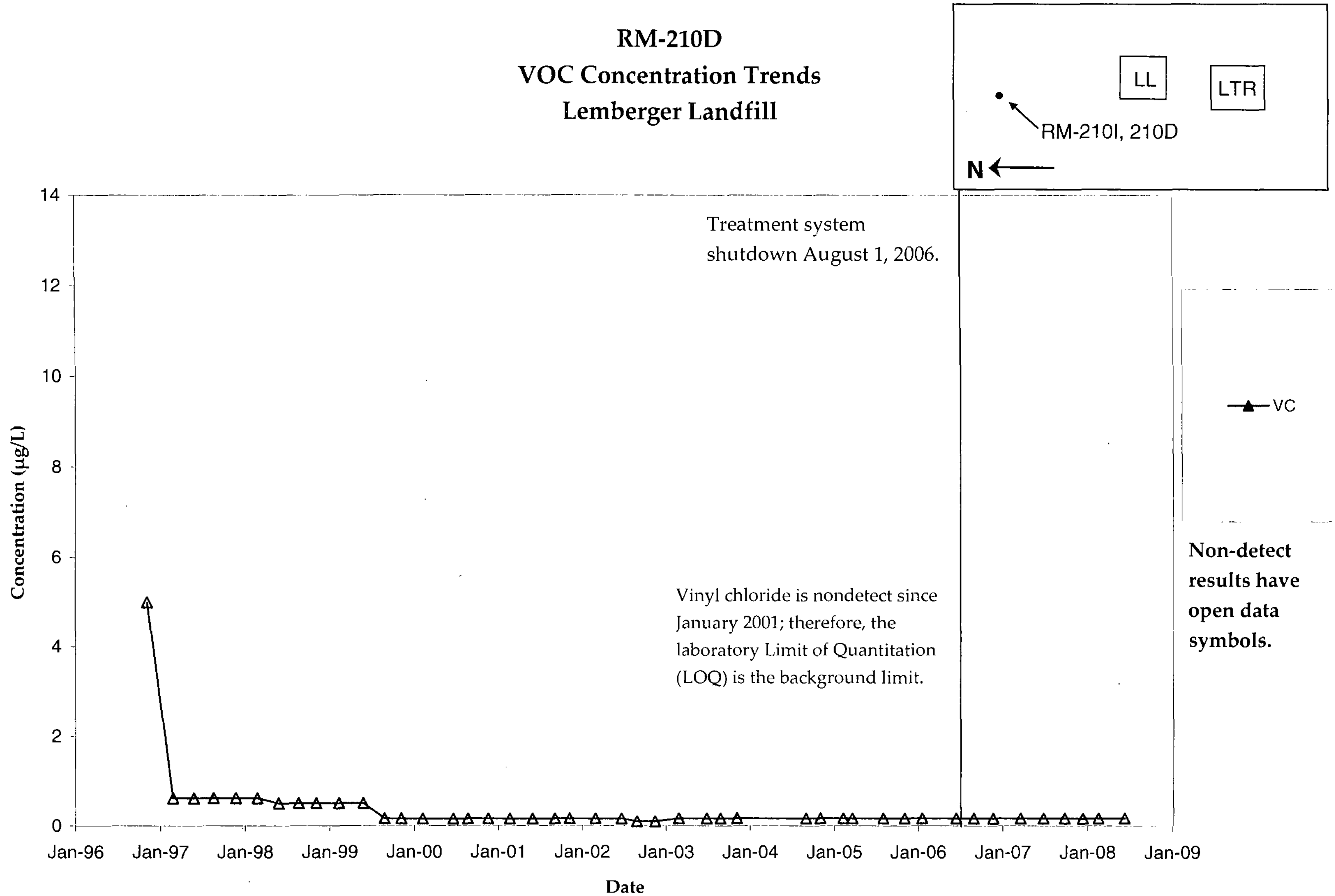
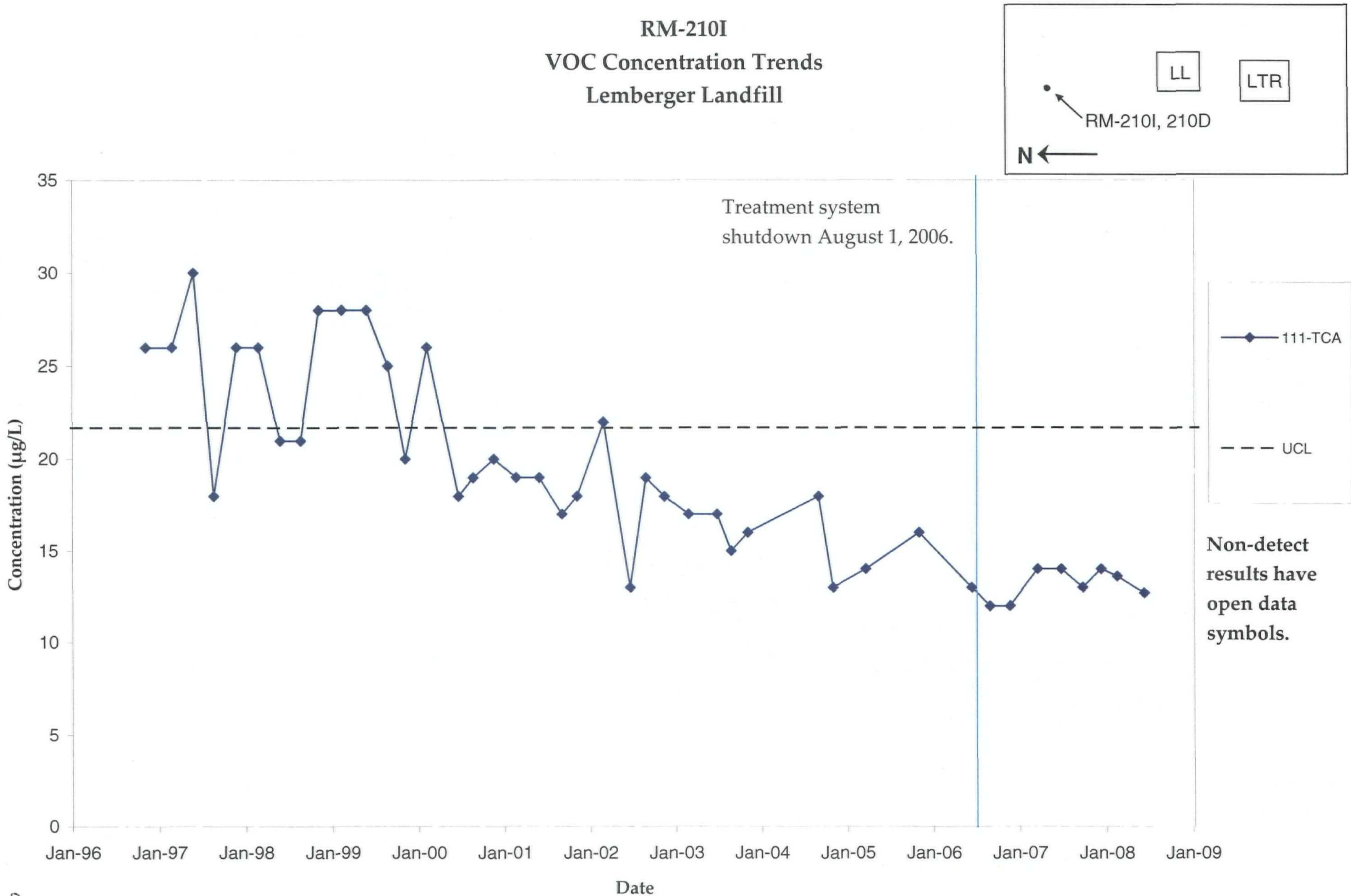
RM-210D
VOC Concentration Trends
Lemberger Landfill



RM-210I
VOC Concentration Trends
Lemberger Landfill



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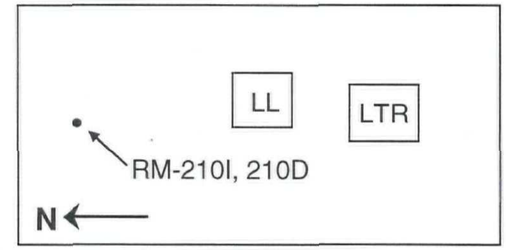
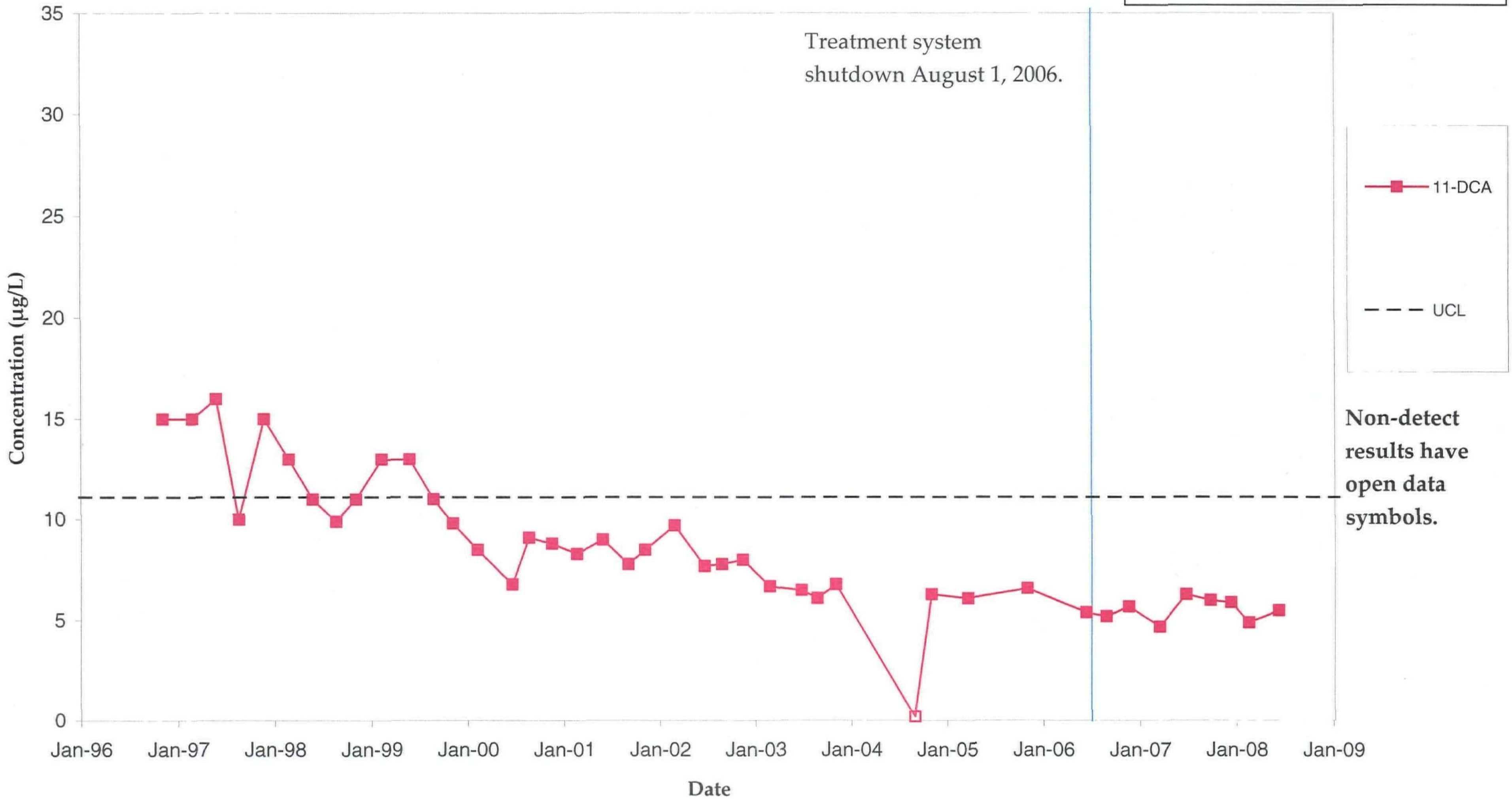
RM-210I
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

30

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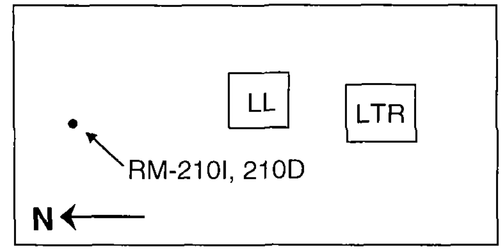
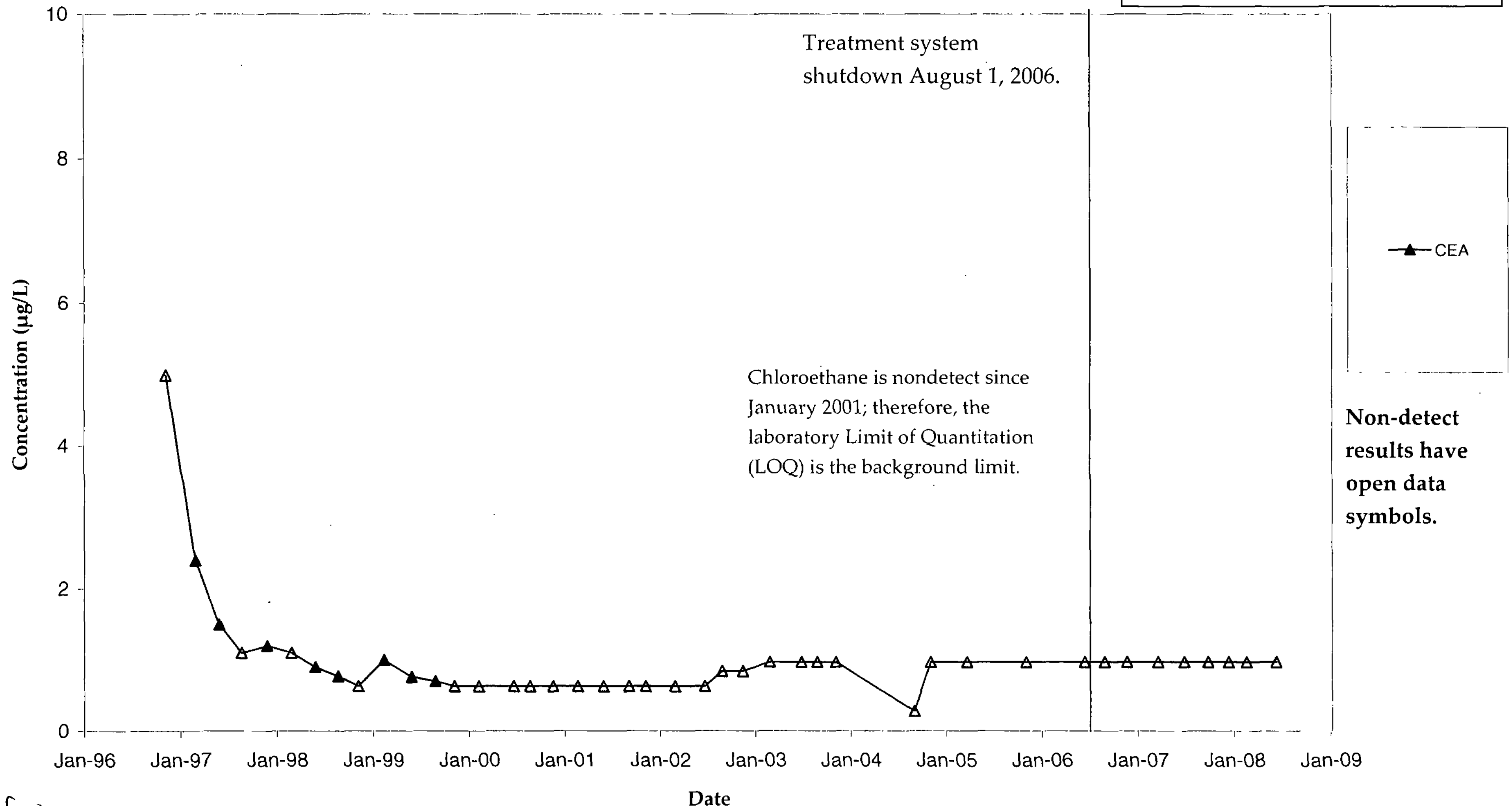
RM-210I
VOC Concentration Trends
Lemberger Landfill





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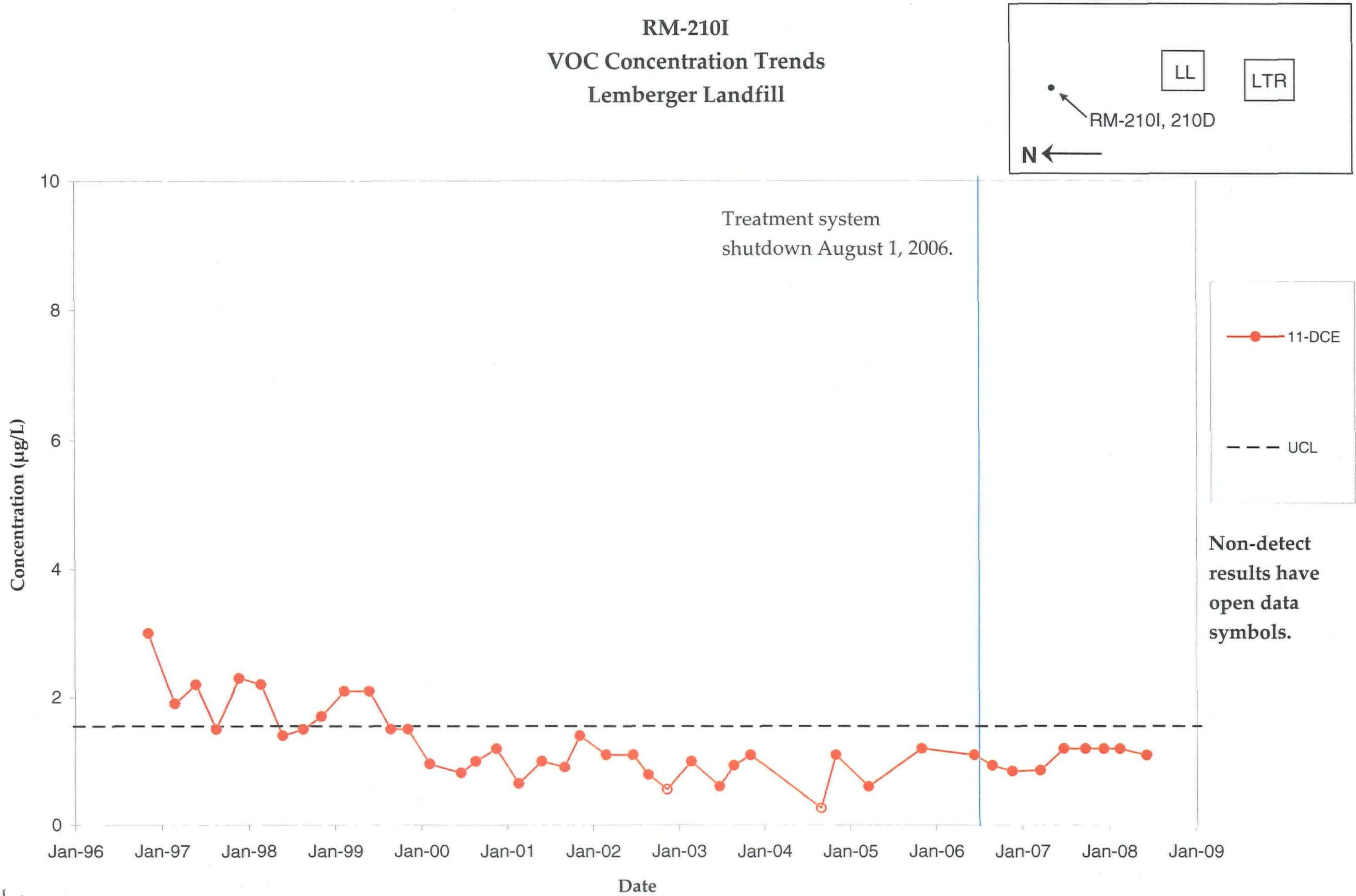

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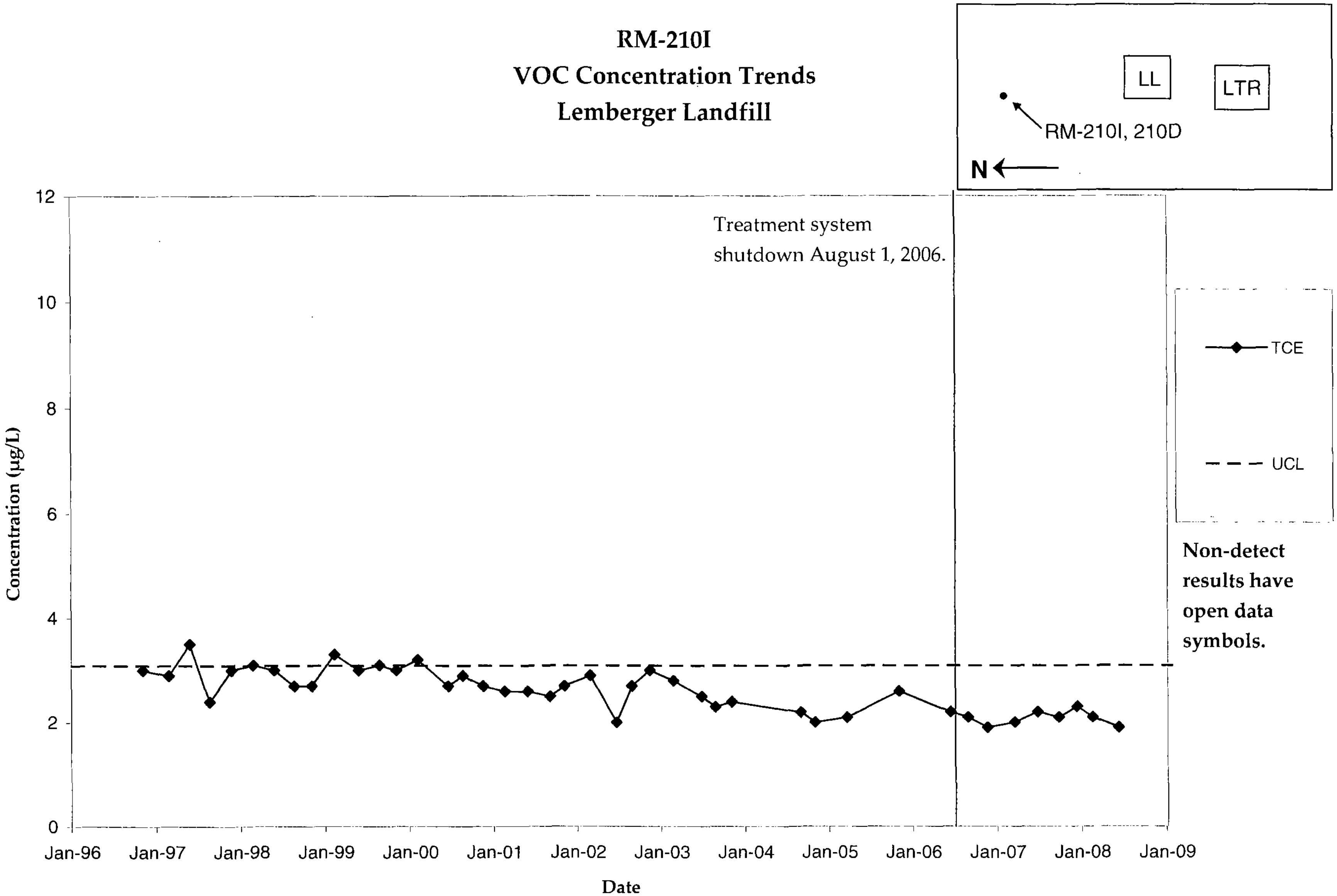
RM-210I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-210I, 210D
N
Treatment system
shutdown August 1, 2006.
TCE
UCL
Non-detect results have open data symbols.
Concentration (µg/L)
0
2
4
6
8
10
12
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
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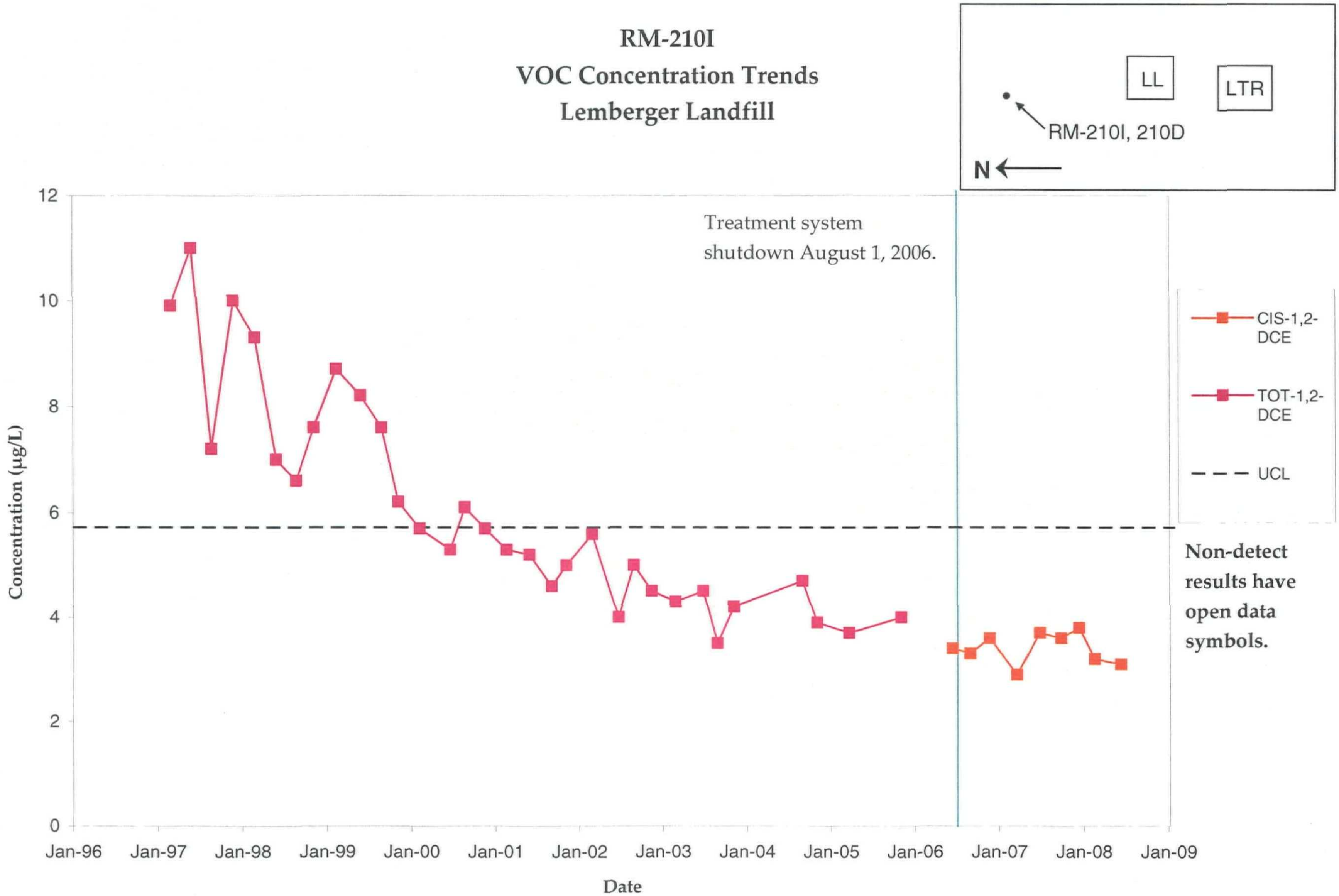
Jan-08
Jan-09
Date



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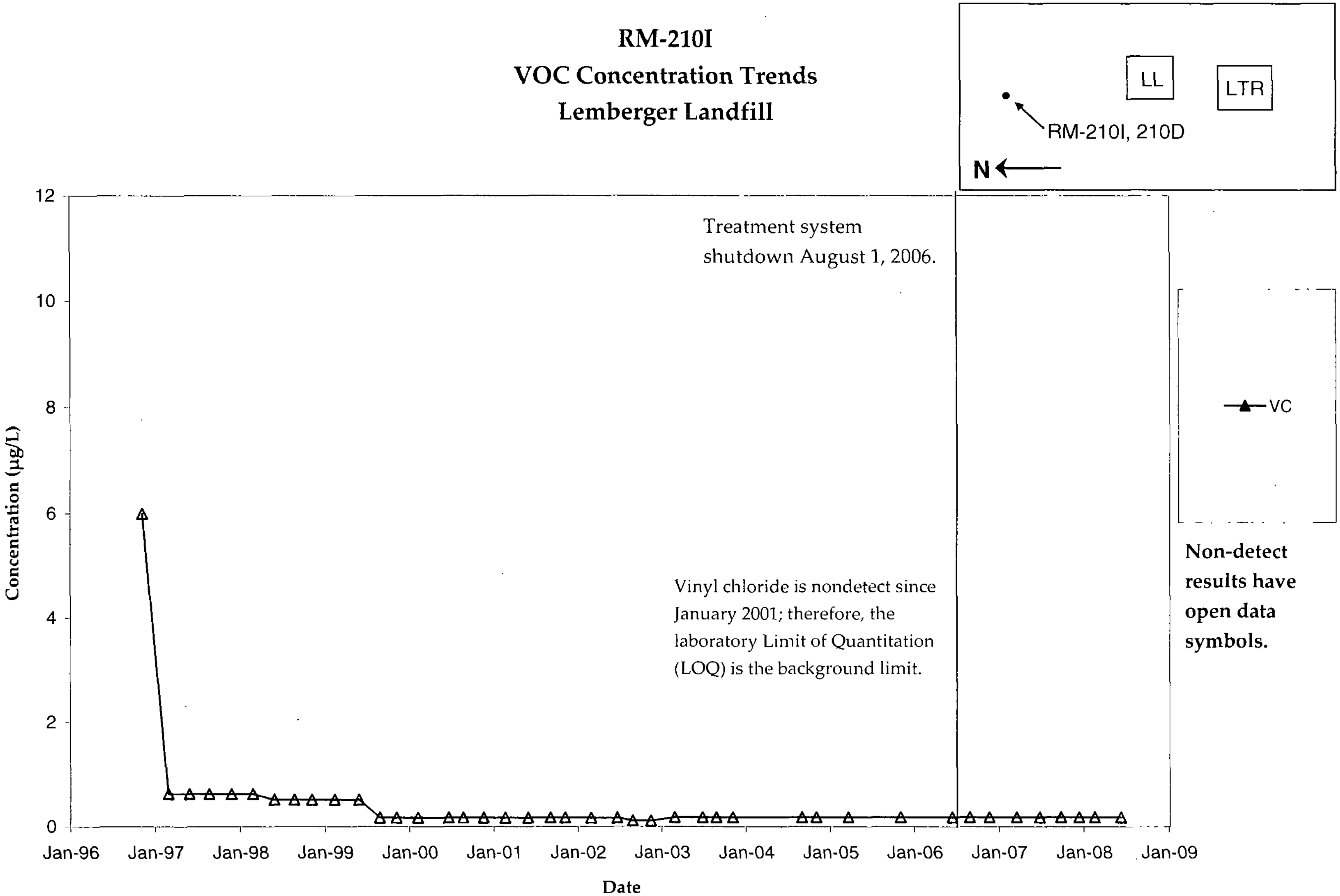
RM-210I
VOC Concentration Trends
Lemberger Landfill



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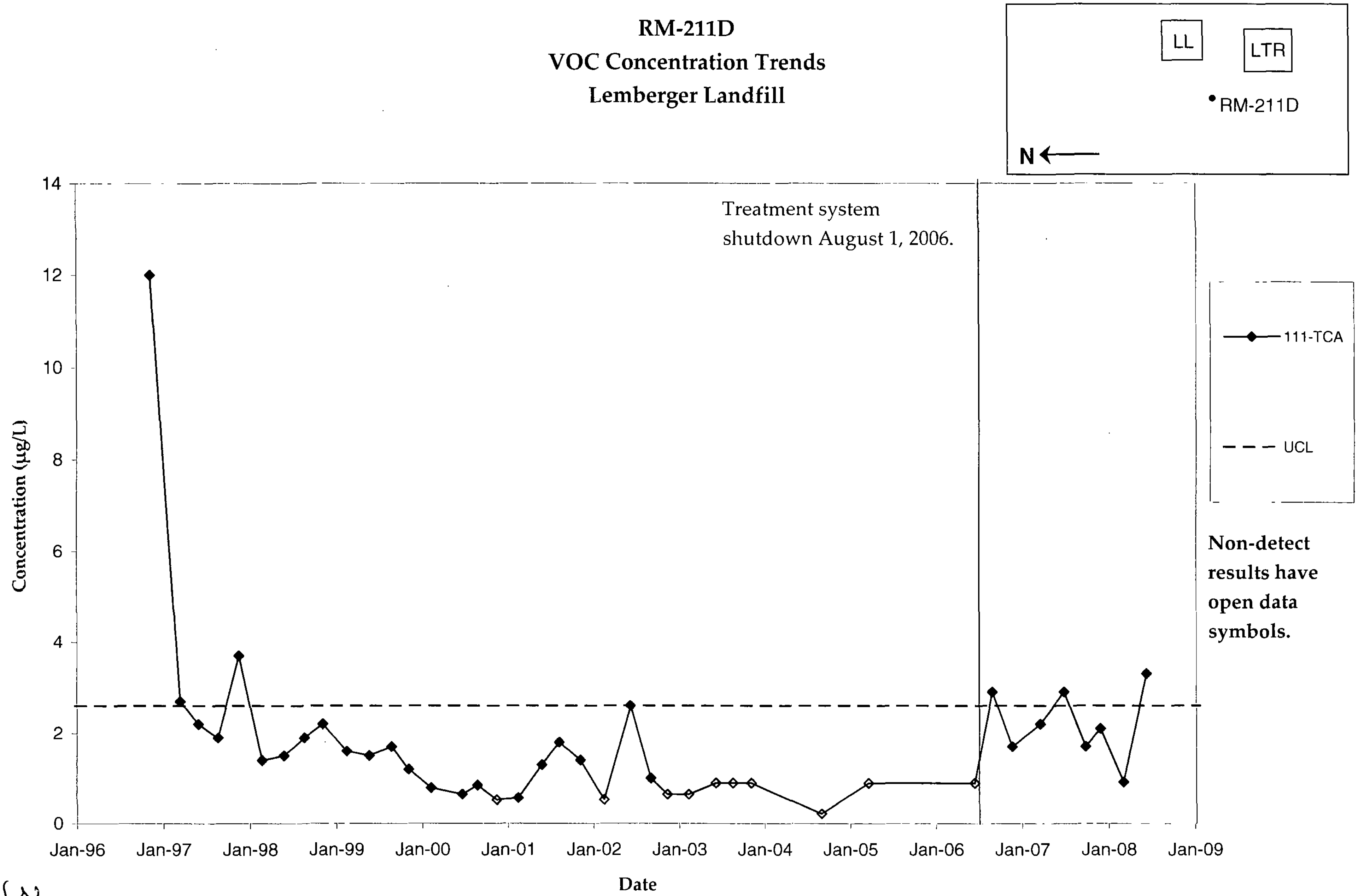
RM-211D
VOC Concentration Trends
Lemberger Landfill



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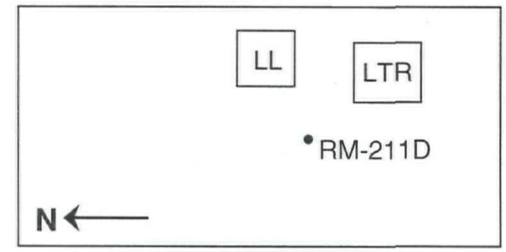
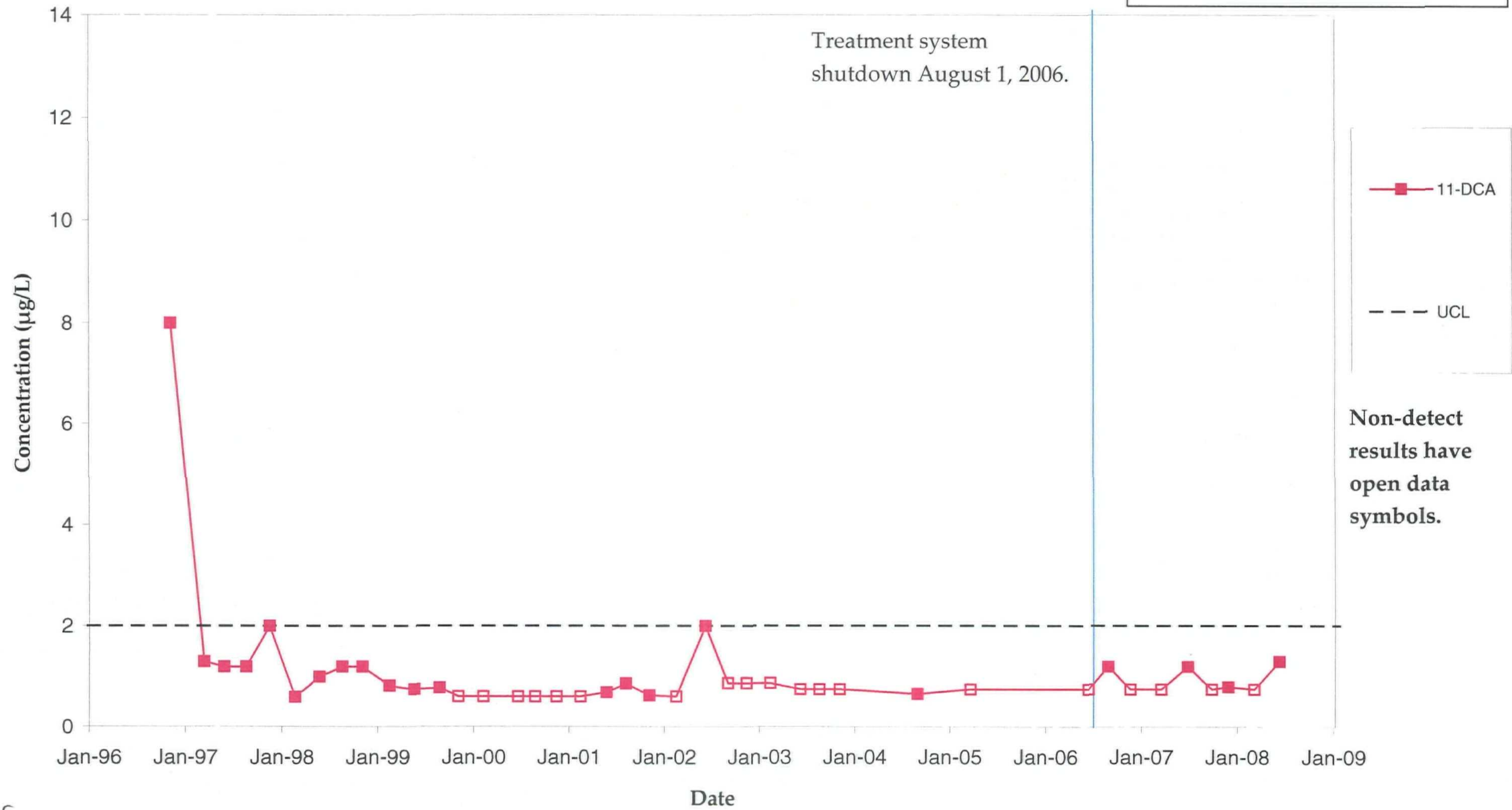
RM-211D
VOC Concentration Trends
Lemberger Landfill





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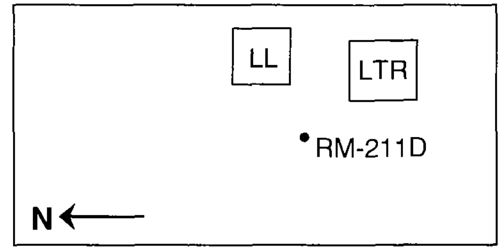
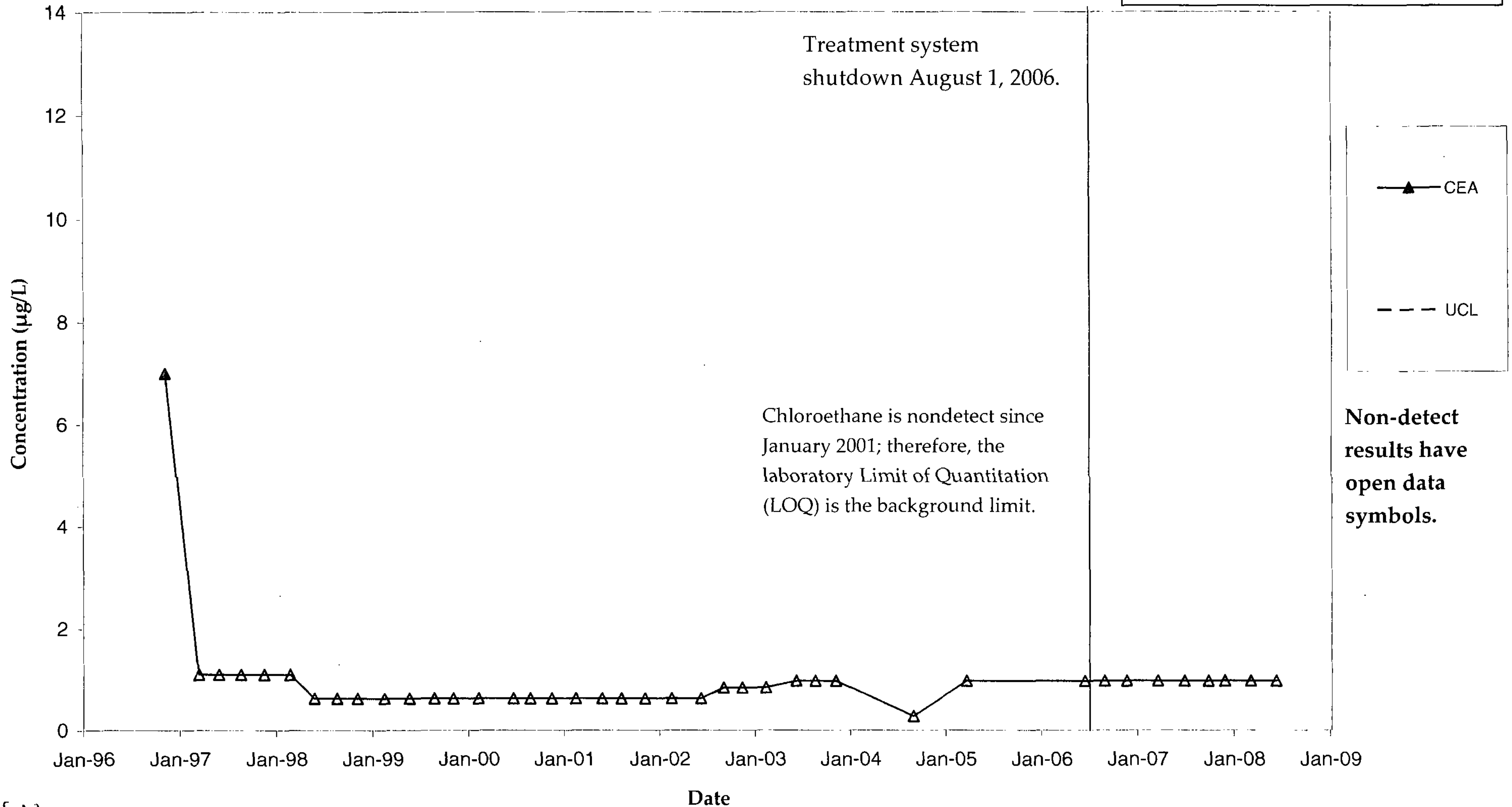


RM-211D
VOC Concentration Trends
Lemberger Landfill



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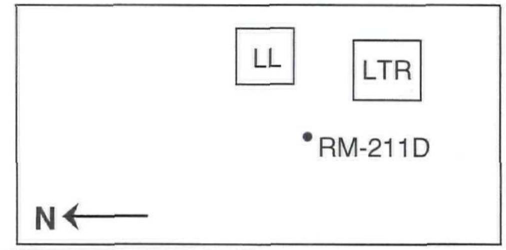
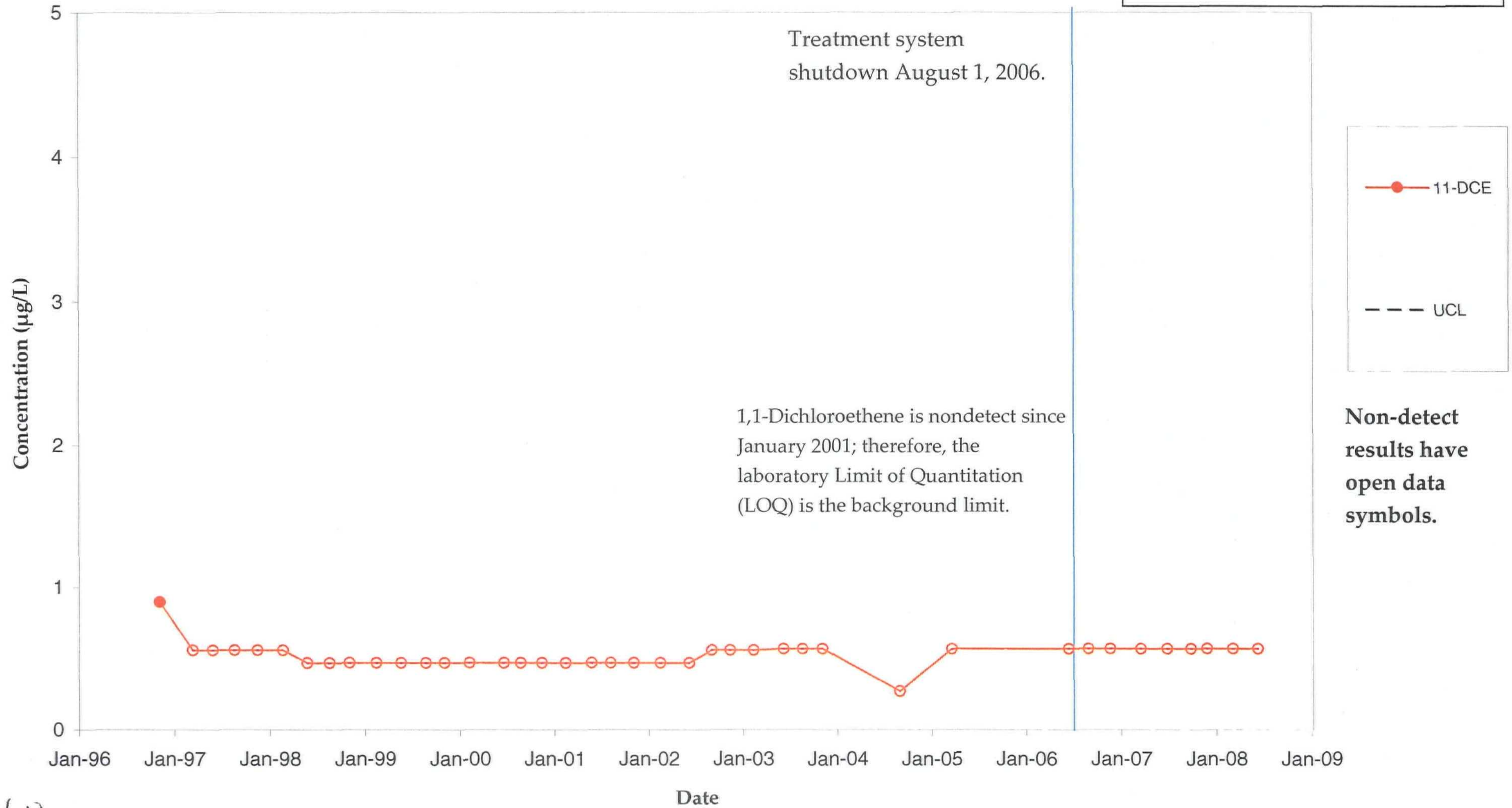
RM-211D
VOC Concentration Trends
Lemberger Landfill





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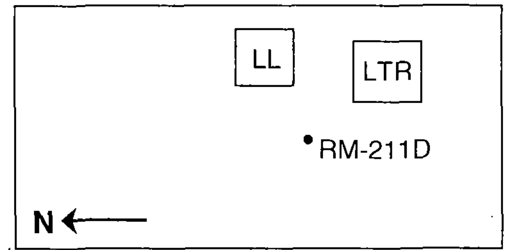
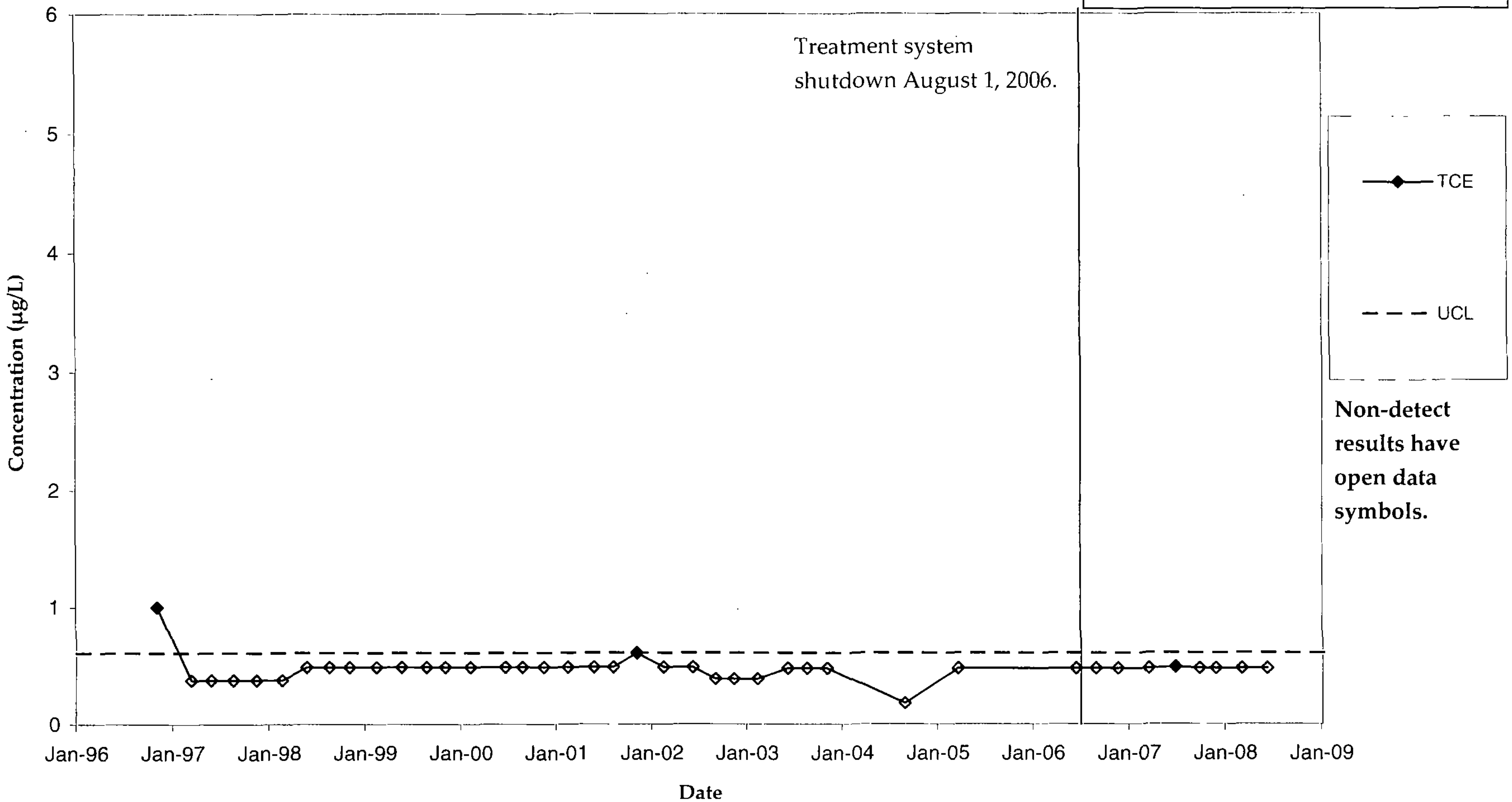
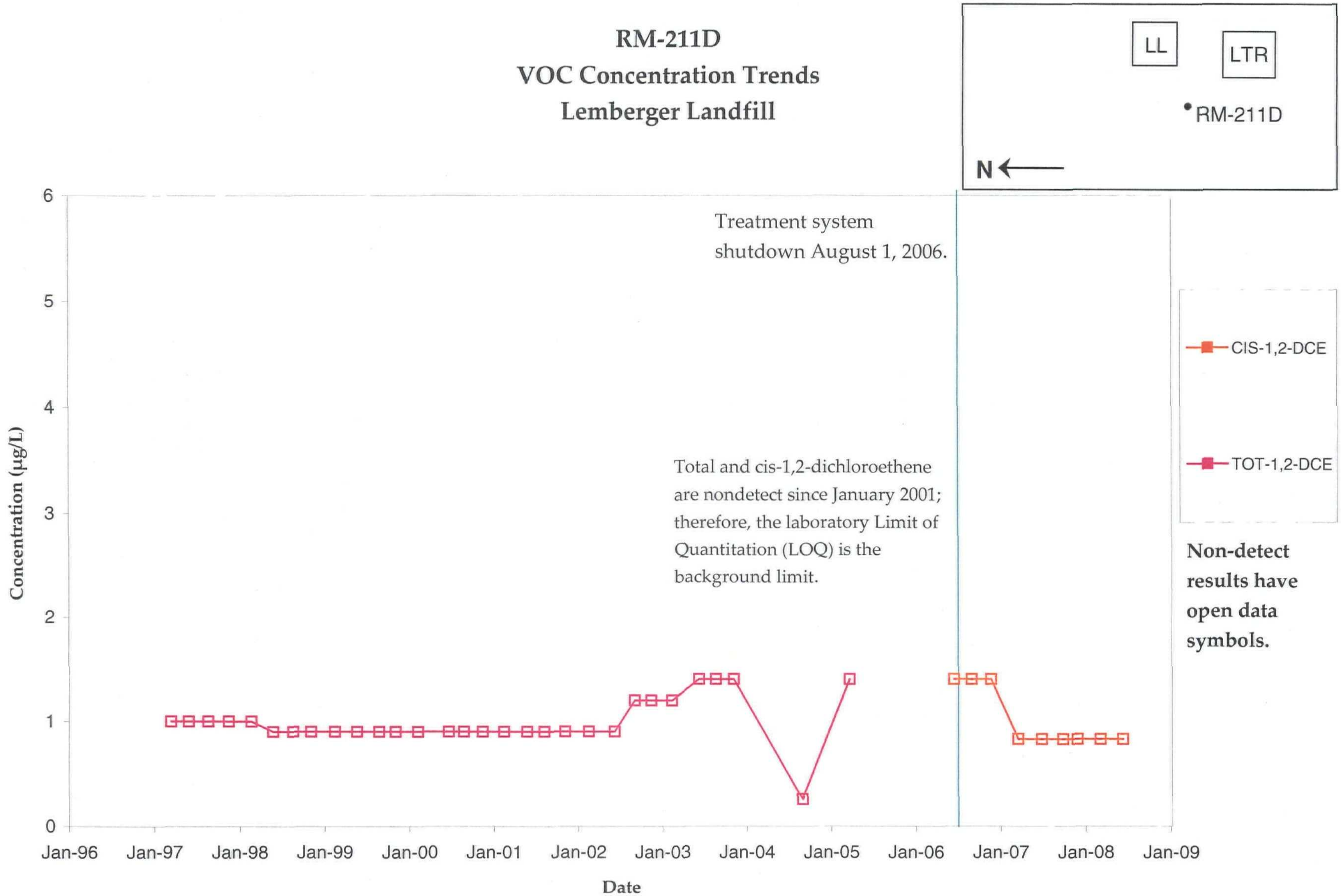
RM-211D
VOC Concentration Trends
Lemberger Landfill

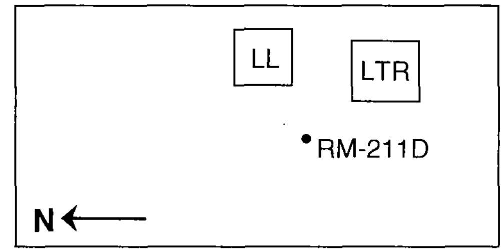


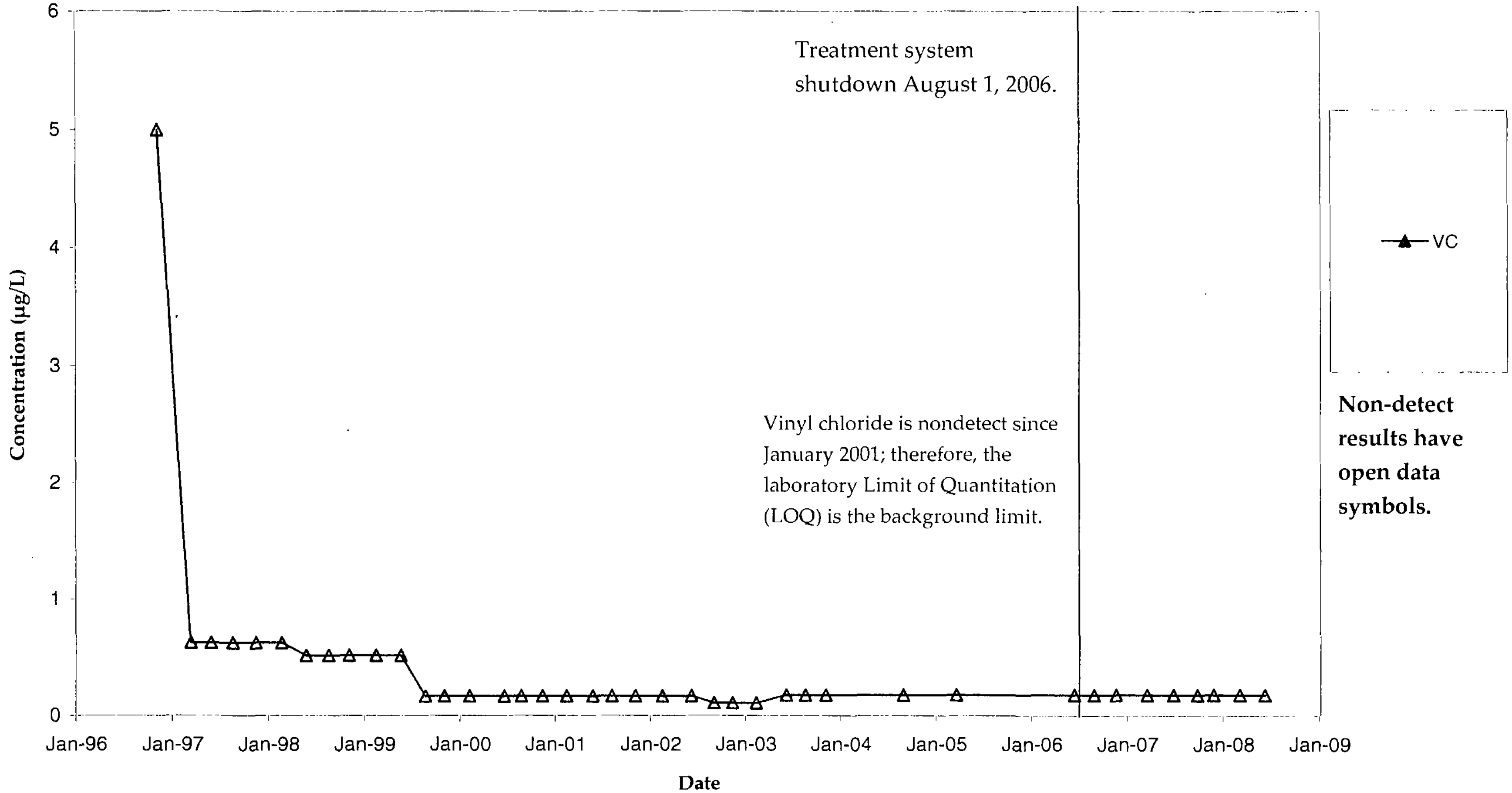


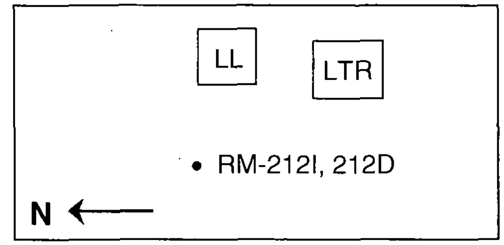
RM-211D
VOC Concentration Trends
Lemberger Landfill



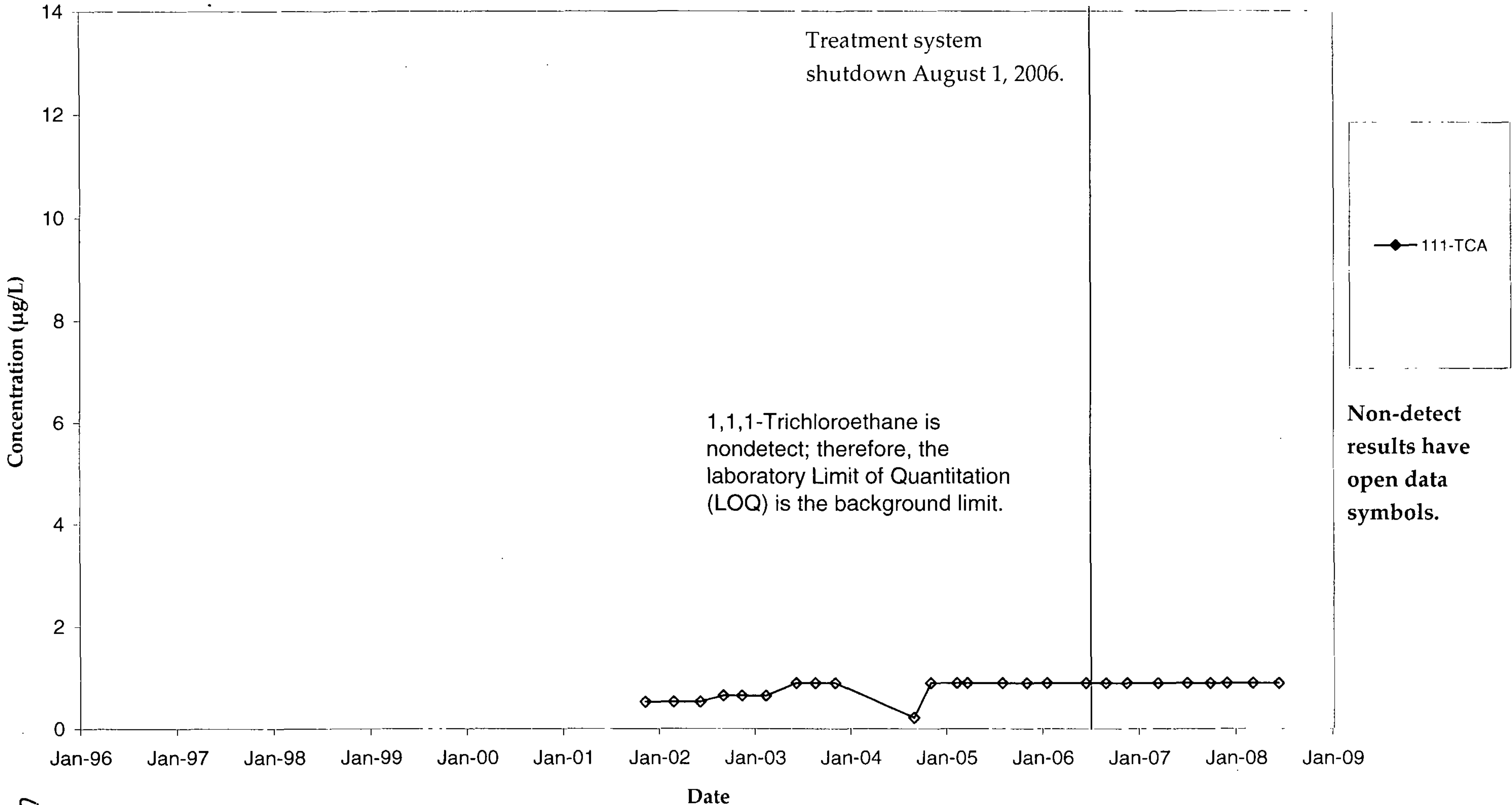
RM-211D
VOC Concentration Trends
Lemberger Landfill







RM-212D
VOC Concentration Trends
Lemberger Landfill



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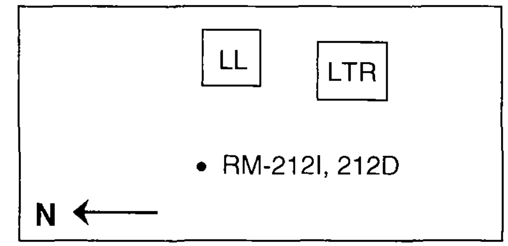
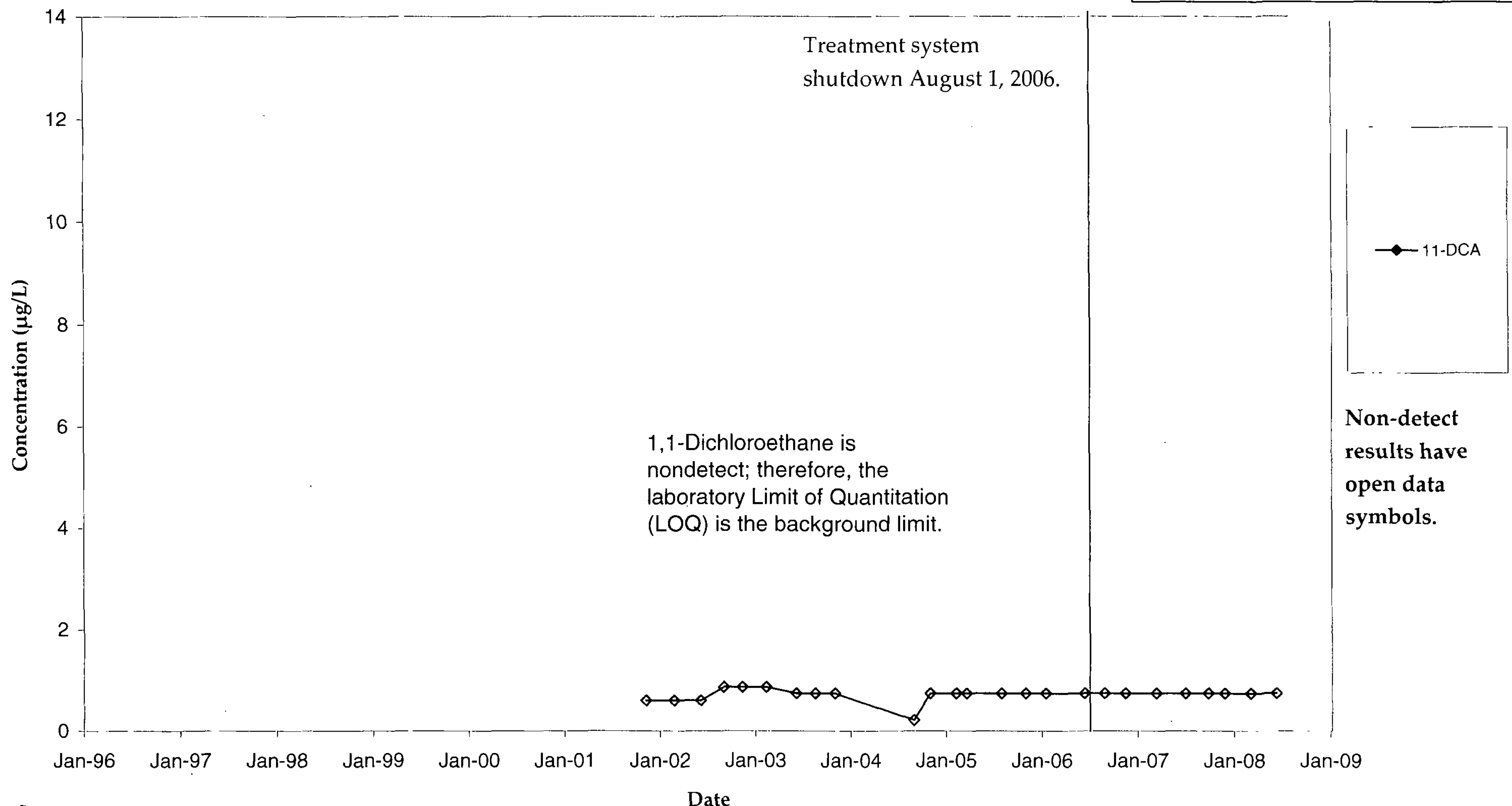
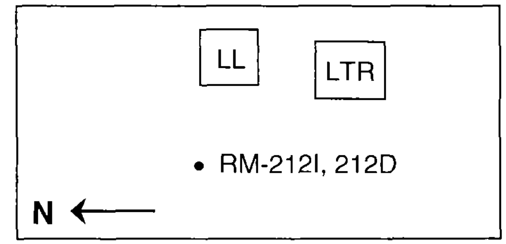
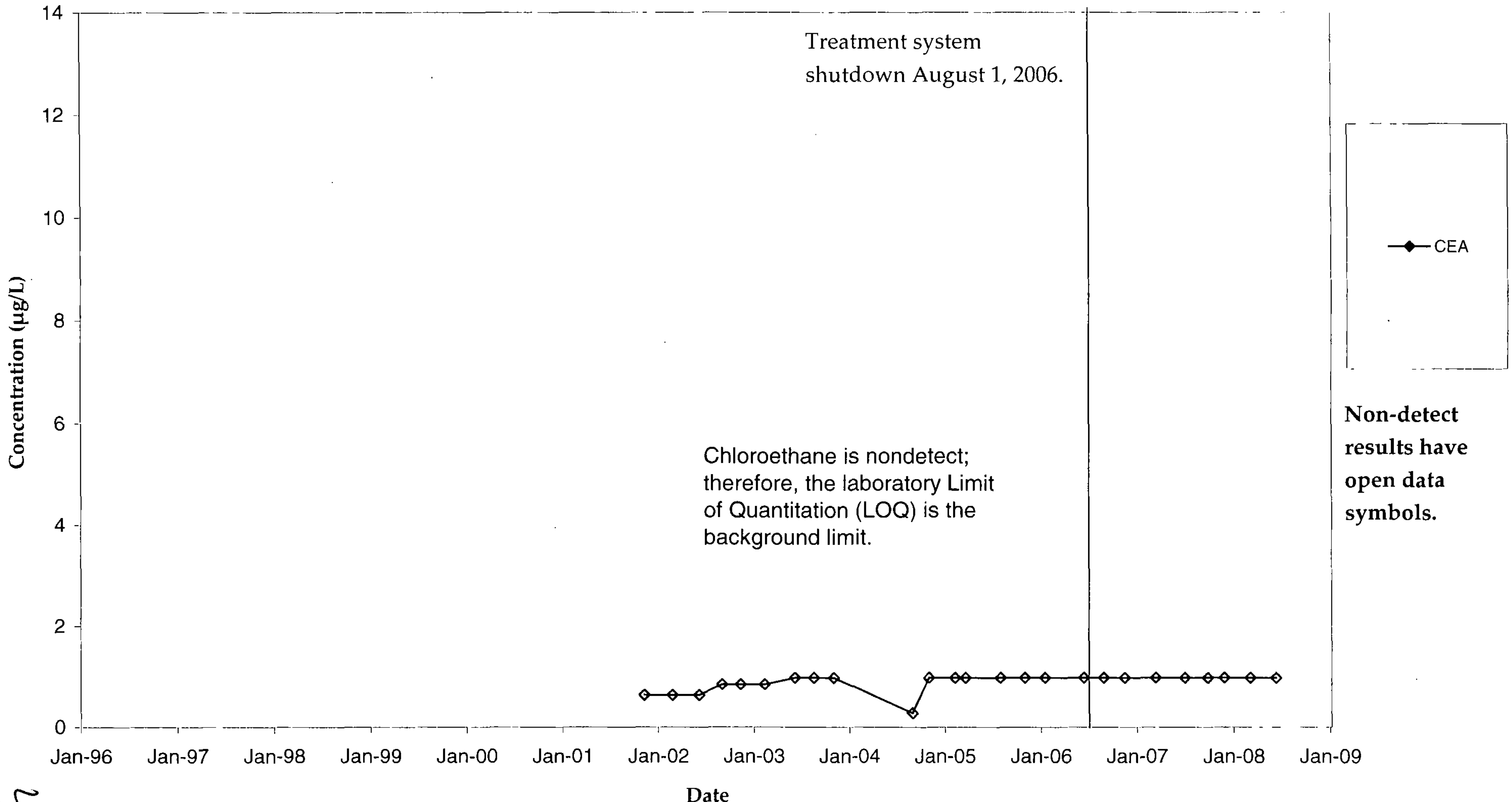
RM-212D
VOC Concentration Trends
Lemberger Landfill





RM-212D
VOC Concentration Trends
Lemberger Landfill

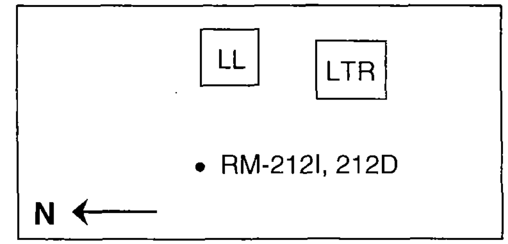


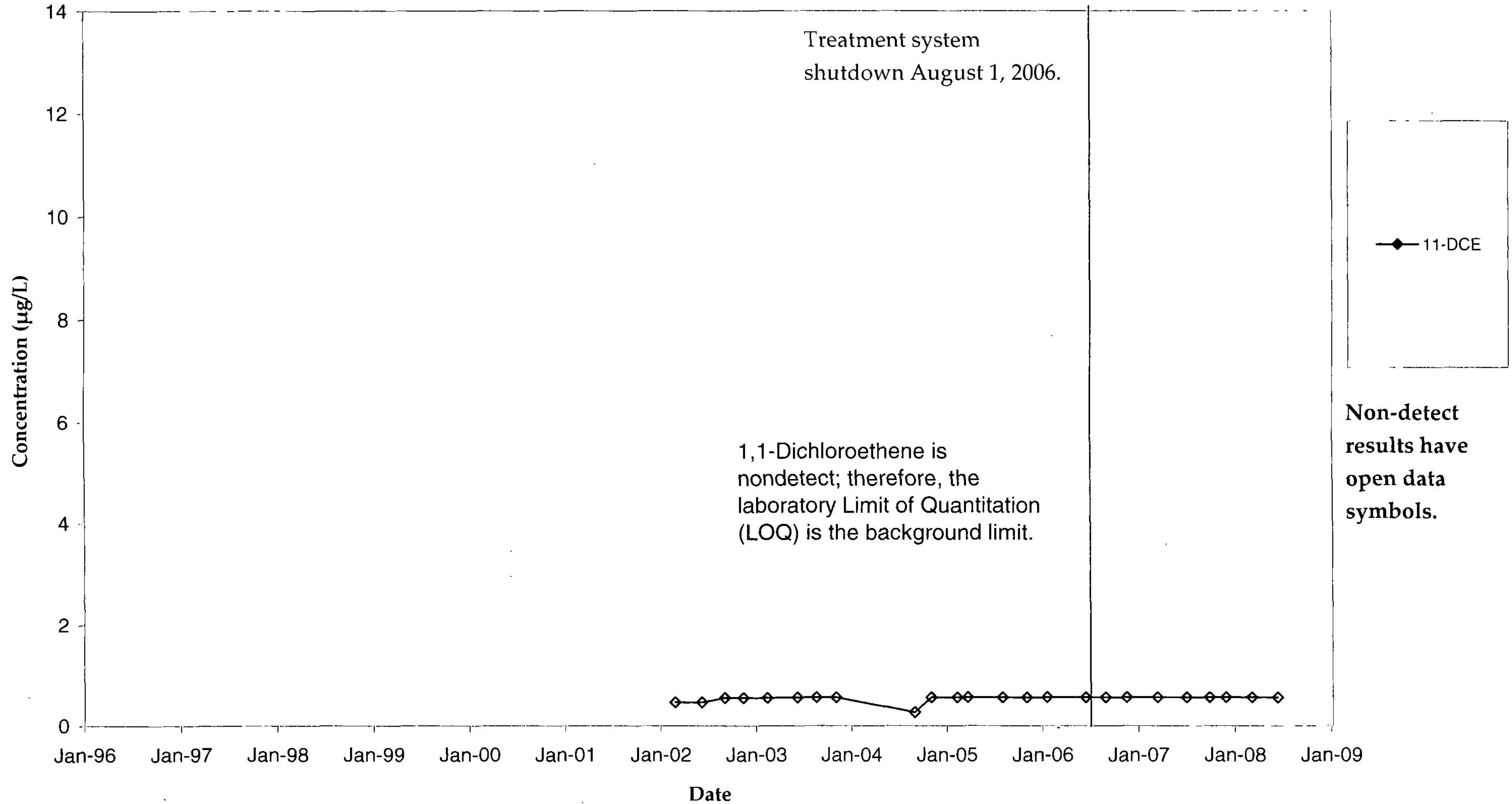


Non-detect results have open data symbols.

45

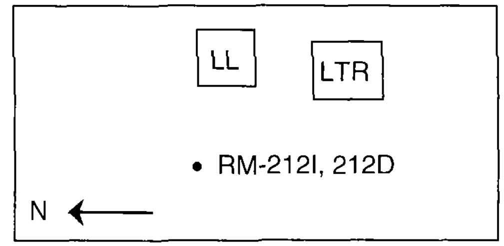
RM-212D
VOC Concentration Trends
Lemberger Landfill

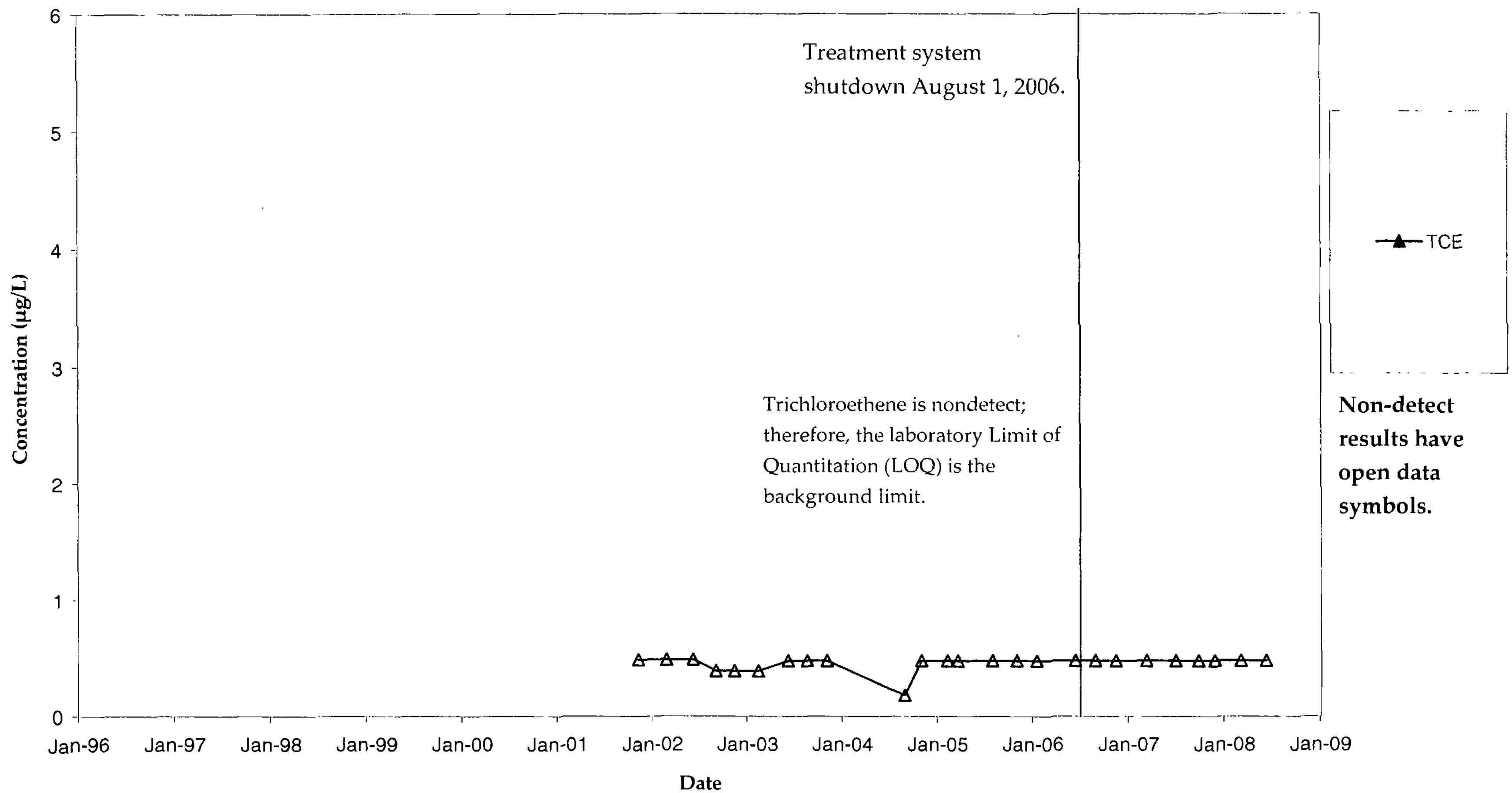




46

RM-212D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

47

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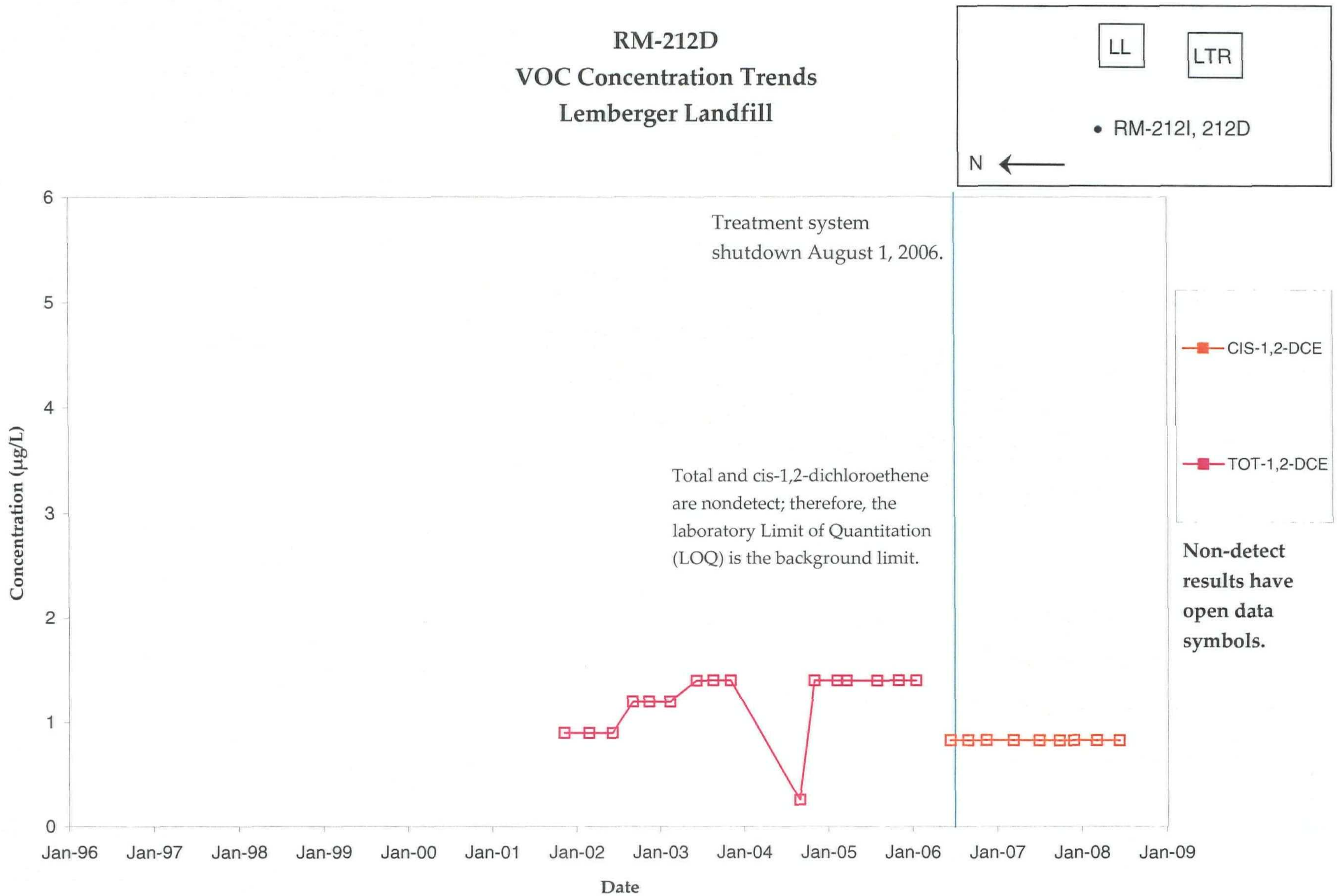

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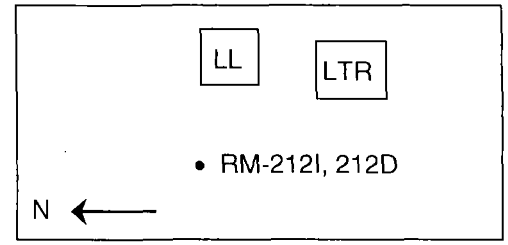
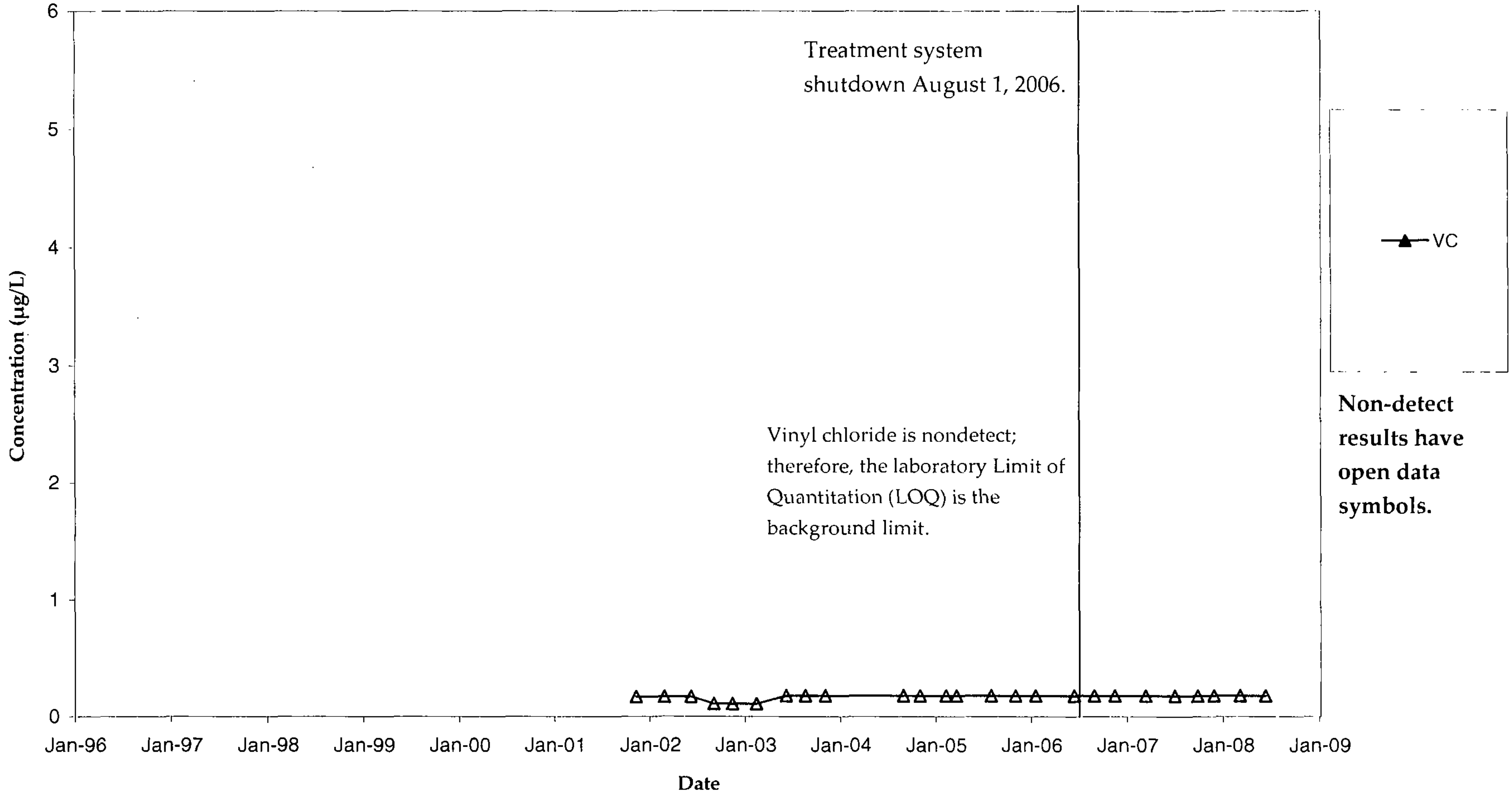
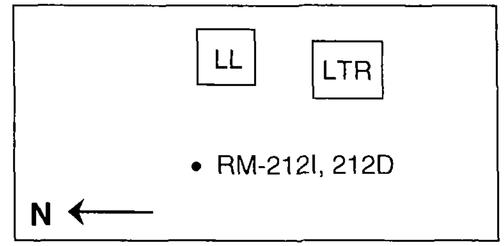
RM-212D
VOC Concentration Trends
Lemberger Landfill

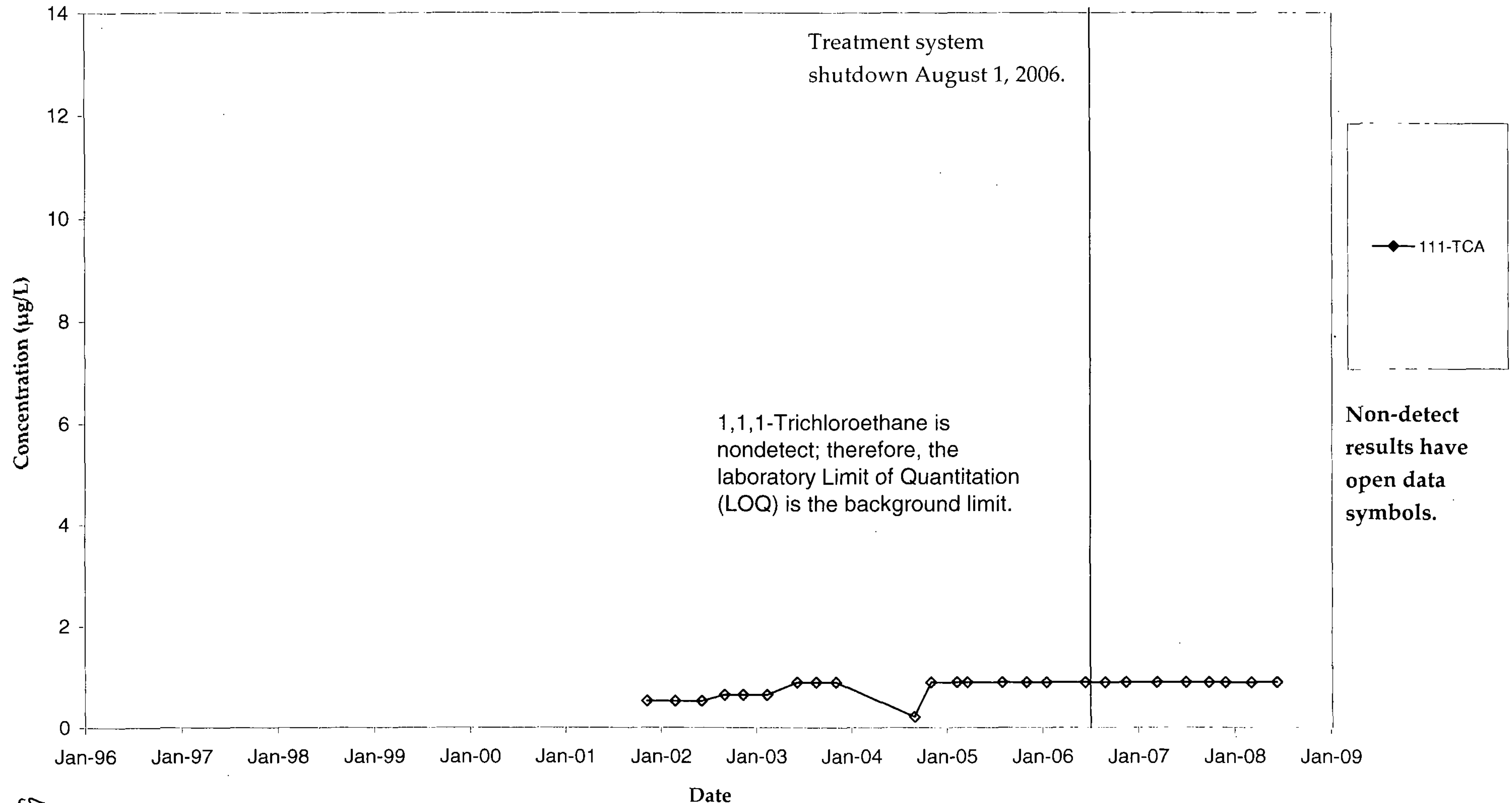




49

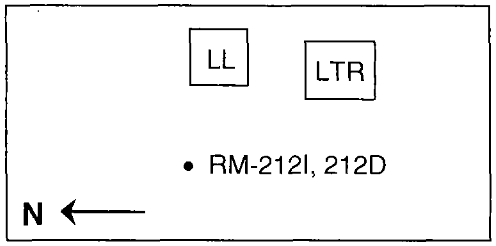
RM-212I
VOC Concentration Trends
Lemberger Landfill

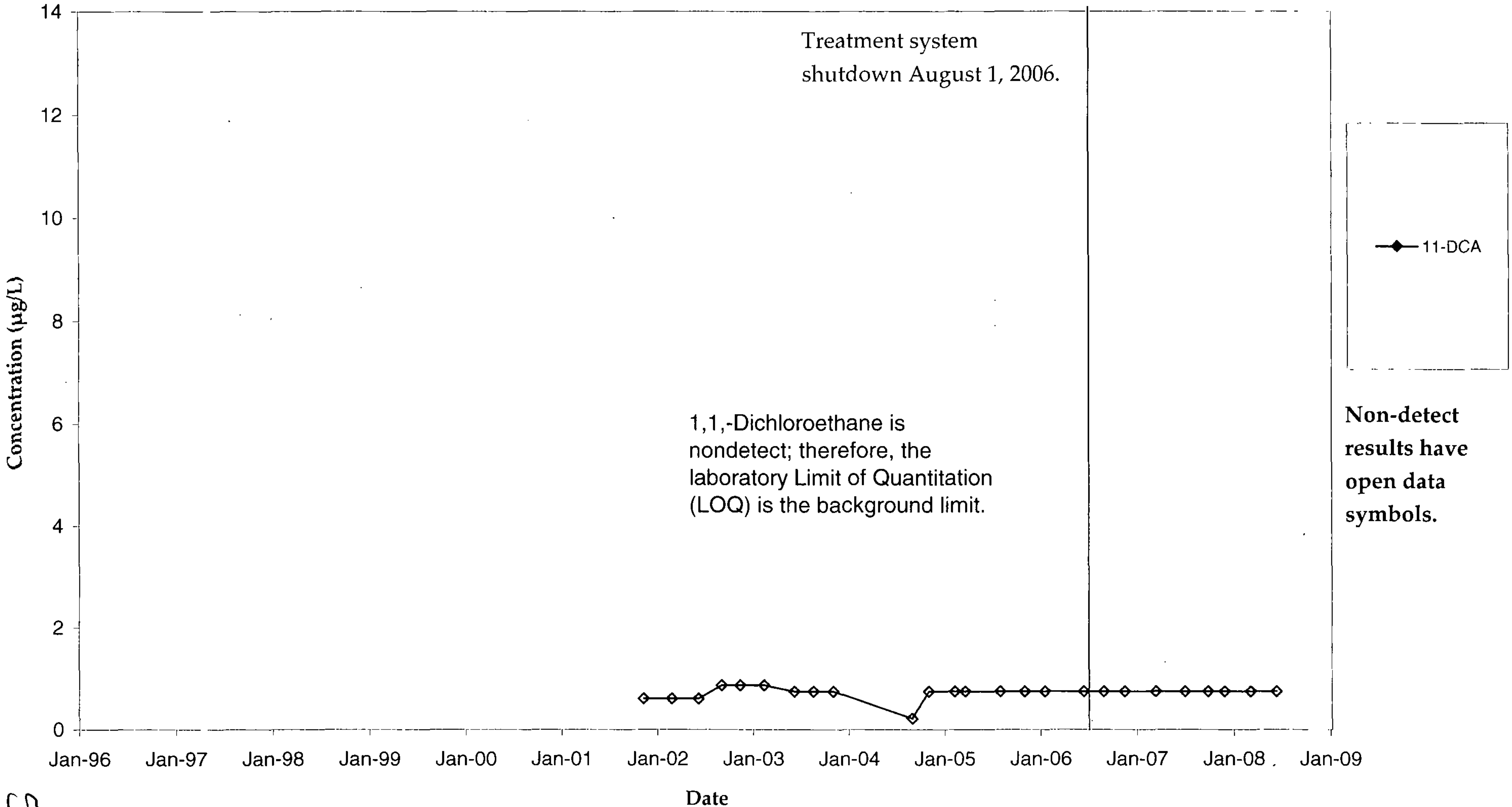




8

RM-212I
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

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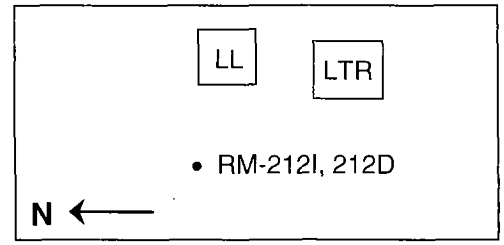
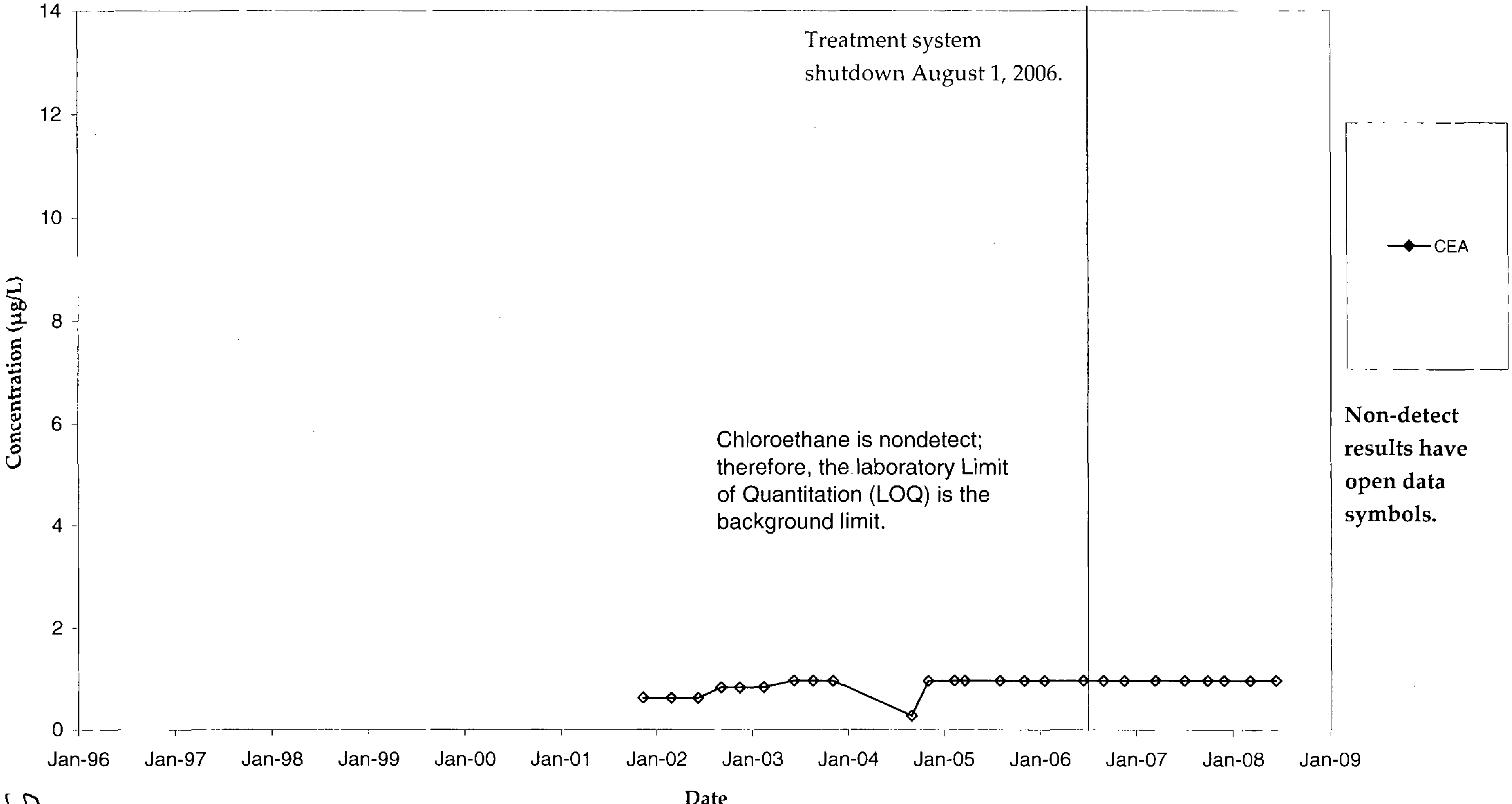
RM-212I
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

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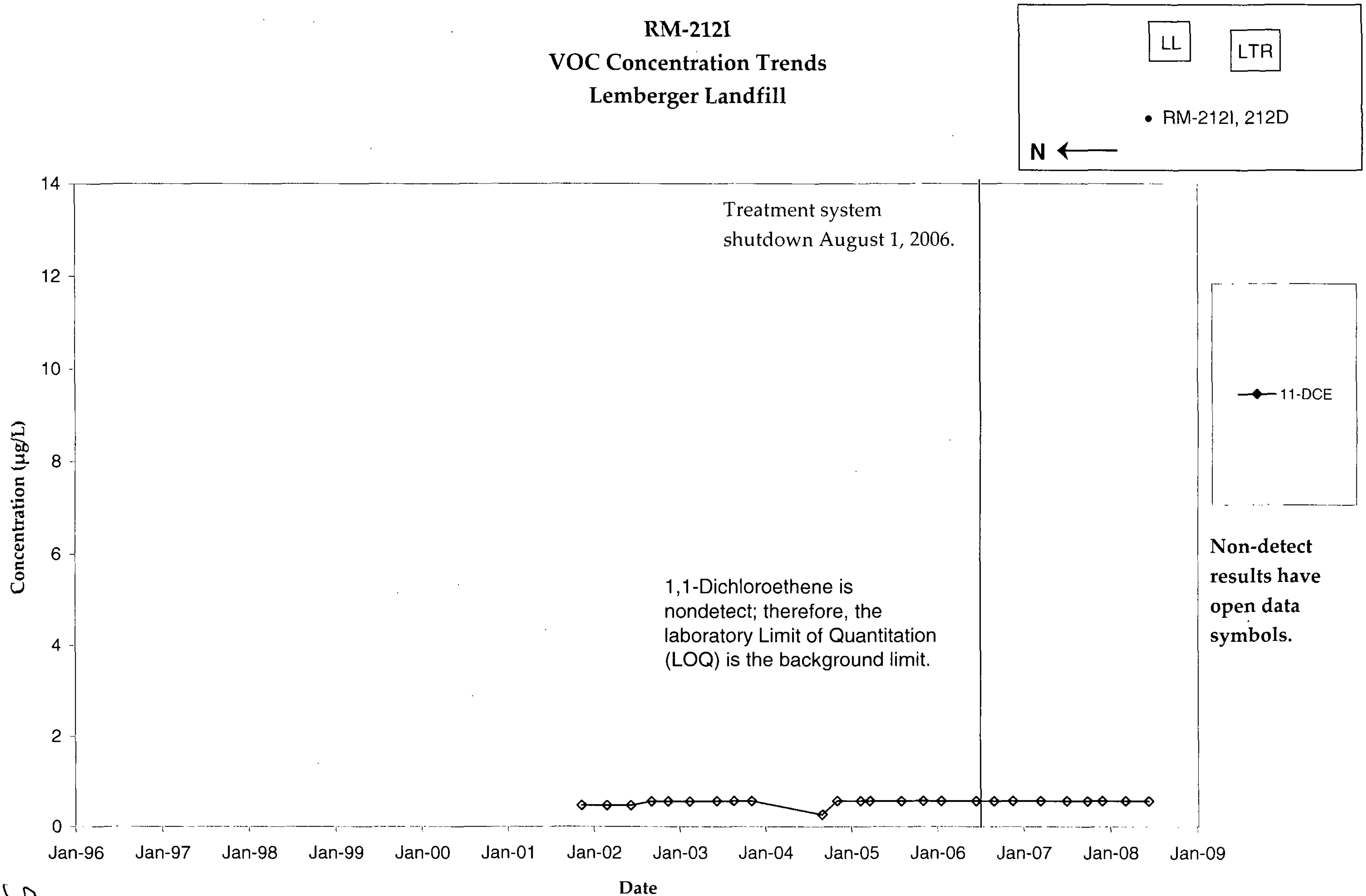
RM-212I
VOC Concentration Trends
Lemberger Landfill



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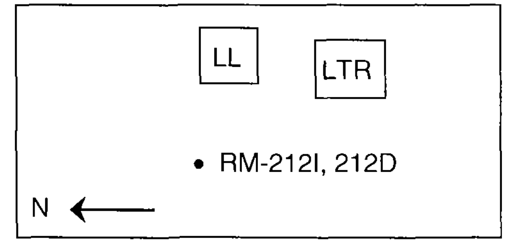
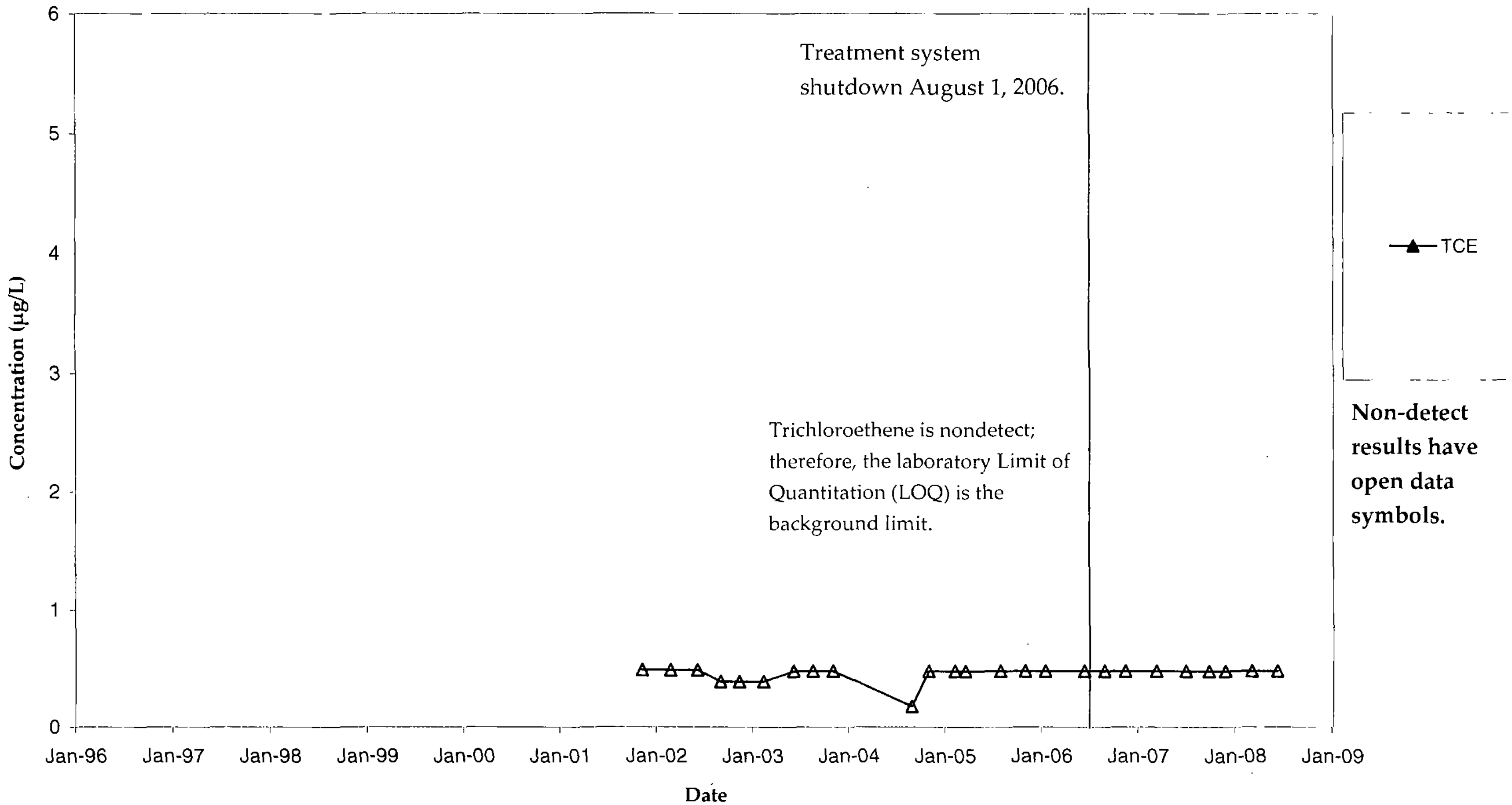
RM-212I
VOC Concentration Trends
Lemberger Landfill





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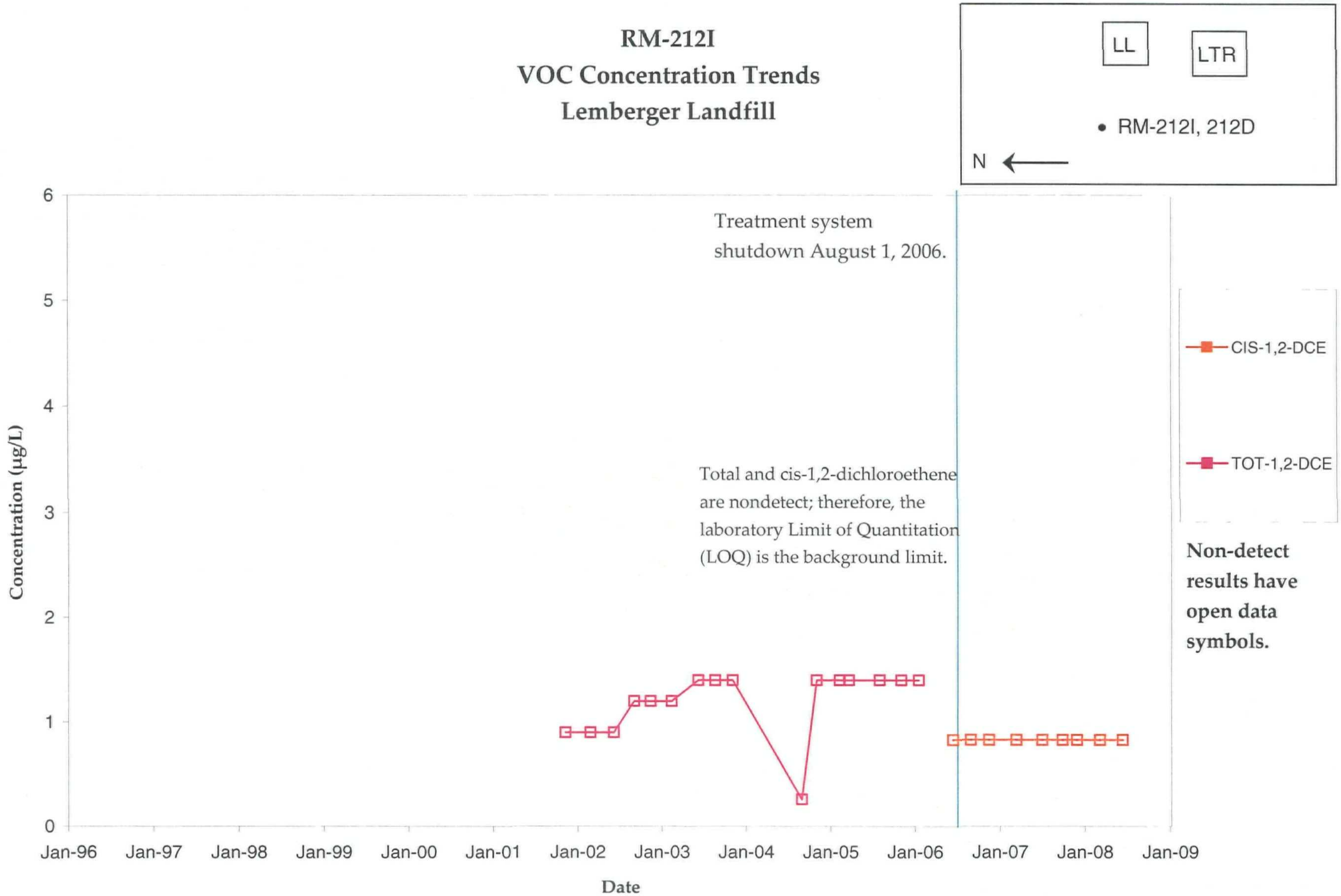
RM-212I
VOC Concentration Trends
Lemberger Landfill



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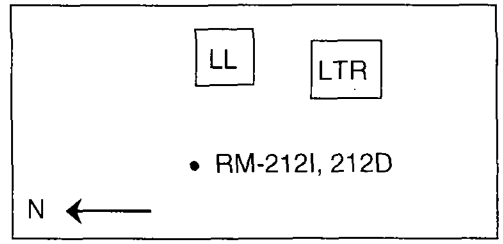
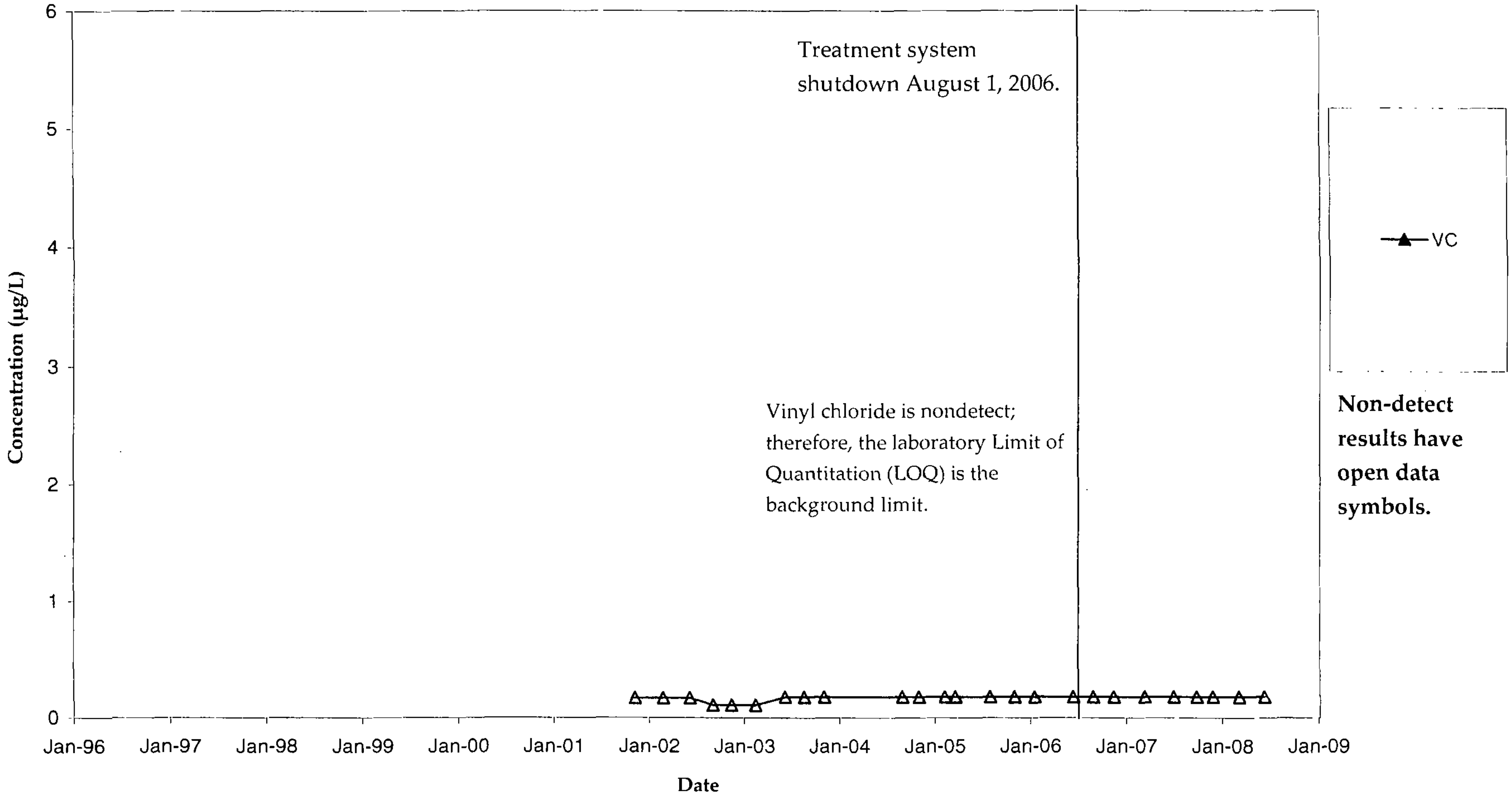
RM-212I
VOC Concentration Trends
Lemberger Landfill





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BACKGROUND UPPER 95% CONFIDENCE LIMIT CALCULATIONS
LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES

	SENTINEL WELL RM-002D						
DATE	**TCE**	**1,2-DCE**	**VC**	**111-TCA**	**11-DCA**	**CEA**	**11-DCE**
9-Mar-01	1.6	2.9	< 0.17	6.8	4	< **0.315**	< **0.235**
26-Jun-01	1.5	1.9	< 0.17	4.7	3.1	< **0.315**	0.51
1-Oct-01	1.4	2.9	< 0.17	5.9	4.7	1	0.65
7-Dec-01	1.7	3.5	< 0.17	6.2	5.5	1.1	0.83
27-Mar-02	1.5	2.7	< 0.17	5.9	4.5	1.1	0.81
19-Jul-02	0.98	1.1	< 0.17	2.4	2.3	< **0.315**	< **0.235**
24-Sep-02	1.1	2.1	< 0.11	4.2	3.3	< **0.42**	< **0.28**
12-Dec-02	1.2	2	< 0.11	4.3	3.5	< **0.42**	< **0.28**
25-Mar-03	1.2	1.7	< 0.18	3.7	2.5	< **0.485**	< **0.285**
24-Jul-03	1	< **0.7**	< 0.18	2.6	1.2	< **0.485**	< **0.285**
23-Sep-03	0.73	< **0.7**	< 0.18	2	0.92	< **0.485**	< **0.285**
3-Dec-03	0.8	< **0.7**	< 0.18	1.9	0.79	< **0.485**	< **0.285**
28-Sep-04	0.54	1.2	< 0.18	< **0.11**	1.8	< **0.14**	< **0.27**
30-Nov-04	0.54	< **0.7**	< 0.18	1.7	1.5	< **0.485**	< **0.285**
18-Apr-05	< **0.24**	< **0.7**	< 0.18	1.2	< **0.375**	< **0.485**	< **0.285**
30-Nov-05	< **0.24**	< **0.7**	< 0.18	0.94	< **0.375**	< **0.485**	< **0.285**
12-Jul-06	< **0.24**	< **0.7**	< 0.18	< **0.45**	< **0.375**	< **0.485**	< **0.285**
# Observations:	17	17	17	17	17	17	17
% Nondetect:	17.6	41.2	100.0	11.8	17.6	82.4	76.5
Mean:	0.971	1.582	NA	3.235	2.396	NA	NA
Std Deviation:	0.491	0.961	NA	2.148	1.660	NA	NA
95% UCL:	**1.95**	**3.50**	NA	**7.53**	**5.72**	NA	NA
Nonparametric Limit:	NA	NA	**LOQ**	NA	NA	**1.1**	**0.83**

Notes:

Bold nondetect results have had one-half the detection limit substituted in the confidence limit calculations.

The 95% upper confidence limit (UCL) is equal to the mean plus 2 times the standard deviation.

A 95% UCL was calculated for each data set having 50% or fewer nondetect values.

A nonparametric limit was determined for each data set having between 50% and 100% nondetect values.

The LOQ is the "background limit" for each data set having 100% nondetect values.

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BACKGROUND UPPER 95% CONFIDENCE LIMIT CALCULATIONS
LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES

	SENTINEL WELL RM-203D						
DATE	**TCE**	**1,2-DCE**	**VC**	**111-TCA**	**11-DCA**	**CEA**	**11-DCE**
19-Mar-01	0.93	2.3	< 0.17	9.1	4.1	< 0.63	0.54
26-Jun-01	1	2.5	< 0.17	10	4.7	< 0.63	0.71
1-Oct-01	0.94	2.1	< 0.17	9.5	3.9	< 0.63	0.61
5-Dec-01	1	1.8	< 0.17	8.3	3.7	< 0.63	0.59
12-Mar-02	1	2.1	< 0.17	9.3	3.7	< 0.63	0.63
19-Jul-02	0.8	1.5	< 0.17	5.6	3.1	< 0.63	< 0.47
3-Oct-02	0.77	1.5	< 0.11	7.2	2.7	< 0.84	< 0.56
12-Dec-02	1.1	1.6	< 0.11	8.1	3.3	< 0.84	< 0.56
17-Mar-03	0.9	1.7	< 0.11	8.5	3.3	< 0.84	0.72
21-Jul-03	0.84	1.8	< 0.18	8.7	3.2	< 0.97	< 0.57
28-Sep-03	0.77	1.5	< 0.18	7.4	2.7	< 0.97	< 0.57
3-Dec-03	0.98	1.8	< 0.18	8.5	3.1	< 0.97	< 0.57
29-Sep-04	0.91	1.9	< 0.18	9.3	3.6	< 0.28	0.63
30-Nov-04	0.86	1.5	< 0.18	7	2.8	< 0.97	0.79
9-Mar-05	0.83	< **0.7**	< 0.18	6.6	2.8	< 0.97	< 0.57
18-Apr-05	0.75	< **0.7**	< 0.18	7.1	2.6	< 0.97	< 0.57
29-Aug-05	0.75	< **0.7**	< 0.18	6.3	2.1	< 0.97	< 0.57
30-Nov-05	0.85	< **0.7**	< 0.18	7	2.3	< 0.97	< 0.57
14-Feb-06	0.72	< **0.7**	< 0.18	5.5	1.8	< 0.97	< 0.57
11-Jul-06	0.74	< **0.7**	< 0.18	5.6	2	< 0.97	< 0.57
# Observations:	20	20	20	20	20	20	20
% Nondetect:	0.0	30.0	100.0	0.0	0.0	100.0	60.0
Mean:	0.872	1.490	NA	7.730	3.075	NA	NA
Std Deviation:	0.108	0.593	NA	1.394	0.745	NA	NA
95% UCL:	**1.09**	**2.68**	NA	**10.52**	**4.56**	NA	NA
Nonparametric Limit:	NA	NA	**LOQ**	NA	NA	**LOQ**	**0.79**

Notes:

Bold nondetect results have had one-half the detection limit substituted in the confidence limit calculations.

The 95% upper confidence limit (UCL) is equal to the mean plus 2 times the standard deviation.

A 95% upper confidence limit was calculated for each data set having 50% or fewer nondetect values.

A nonparametric limit was determined for each data set having between 50% and 100% nondetect values.

The LOQ is the "background limit" for each data set having 100% nondetect values.

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BACKGROUND UPPER 95% CONFIDENCE LIMIT CALCULATIONS
LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES

	SENTINEL WELL RM-203I						
DATE	**TCE**	**1,2-DCE**	**VC**	**111-TCA**	**11-DCA**	**CEA**	**11-DCE**
19-Mar-01	< 0.49	1	< 0.17	4.8	2.1	< 0.63	< 0.47
26-Jun-01	< 0.49	1	< 0.17	5.4	2.3	< 0.63	< 0.47
1-Oct-01	< 0.49	< 0.9	< 0.17	3.8	1.3	< 0.63	< 0.47
5-Dec-01	< 0.49	< 0.9	< 0.17	2.7	0.82	< 0.63	< 0.47
12-Mar-02	< 0.49	< 0.9	< 0.17	3.7	1.3	< 0.63	< 0.47
19-Jul-02	< 0.49	< 0.9	< 0.17	2.6	1.4	< 0.63	< 0.47
3-Oct-02	< 0.39	< 1.2	< 0.11	3.6	1.2	< 0.84	< 0.56
12-Dec-02	< 0.39	< 1.2	< 0.11	2.9	1.1	< 0.84	< 0.56
17-Mar-03	< 0.39	< 1.2	< 0.11	4.9	1.6	< 0.84	< 0.56
21-Jul-03	< 0.48	< 1.4	< 0.18	3.5	1.3	< 0.97	< 0.57
28-Sep-03	< 0.48	< 1.4	< 0.18	3.3	1.1	< 0.97	< 0.57
3-Dec-03	< 0.48	< 1.4	< 0.18	3.7	1.2	< 0.97	< 0.57
29-Sep-04	< 0.18	< 0.26	< 0.18	3.2	0.97	< 0.28	< 0.27
30-Nov-04	< 0.48	< 1.4	< 0.18	2.3	< 0.75	< 0.97	< 0.57
18-Apr-05	< 0.48	< 1.4	< 0.18	2	< 0.75	< 0.97	< 0.57
30-Nov-05	< 0.48	< 1.4	< 0.18	2.2	< 0.75	< 0.97	< 0.57
11-Jul-06	< 0.48	< 1.4	< 0.18	2.4	0.82	< 0.97	< 0.57
# Observations:	17	17	17	17	17	17	17
% Nondetect:	100.0	88.2	100.0	0.0	17.6	100.0	100.0
Mean:	NA	NA	NA	3.353	1.221	NA	NA
Std Deviation:	NA	NA	NA	0.987	0.448	NA	NA
95% UCL:	NA	NA	NA	**5.33**	**2.12**	NA	NA
Nonparametric Limit:	**0.59**	**1.0**	**LOQ**	NA	NA	**LOQ**	**LOQ**

Notes:

Bold nondetect results have had one-half the detection limit substituted in the confidence limit calculations.

The 95% upper confidence limit (UCL) is equal to the mean plus 2 times the standard deviation.

A 95% upper confidence limit was calculated for each data set having 50% or fewer nondetect values.

A nonparametric limit was determined for each data set having between 50% and 100% nondetect values.

The LOQ is the "background limit" for each data set having 100% nondetect values.

BACKGROUND UPPER 95% CONFIDENCE LIMIT CALCULATIONS
LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES

DATE	SENTINEL WELL RM-210D						
	TCE	1,2-DCE	VC	111-TCA	11-DCA	CEA	11-DCE
19-Mar-01	4.8	11	< 0.17	33	17	0.75	2.7
26-Jun-01	5.3	11	< 0.17	37	19	0.84	2.9
1-Oct-01	4.7	9.5	< 0.17	31	15	0.65	2.5
4-Dec-01	5.2	9.8	< 0.17	32	15	< 0.63	2.8
27-Mar-02	4.7	10	< 0.17	34	17	0.96	3.3
19-Jul-02	4.2	8.7	< 0.17	22	15	< 0.63	2.8
24-Sep-02	4.9	9.7	< 0.11	31	15	< 0.84	2.4
12-Dec-02	4.8	8.9	< 0.11	28	14	< 0.84	2.6
25-Mar-03	5.2	9.2	< 0.18	28	14	< 0.97	2.6
24-Jul-03	4.3	10	< 0.18	31	15	< 0.97	2.1
23-Sep-03	4	8.1	< 0.18	28	14	< 0.97	2.5
3-Dec-03	5	9.8	< 0.18	32	17	< 0.97	3.1
28-Sep-04	4.6	11	< 0.18	36	19	< 0.28	3.3
30-Nov-04	4.5	8.6	< 0.18	26	14	< 0.97	2.7
9-Mar-05	4.5	8.8	< 0.18	26	15	< 0.97	2.7
18-Apr-05	4.4	8.1	< 0.18	27	14	< 0.97	2.5
29-Aug-05	3.8	7.7	< 0.18	22	13	< 0.97	2
30-Nov-05	4.8	8.2	< 0.18	28	15	< 0.97	3.1
14-Feb-06	4.1	7.6	< 0.18	24	13	< 0.97	2.5
11-Jul-06	4.3	7.5	< 0.18	23	13	< 0.97	2.5
# Observations:	20	20	20	20	20	20	20
% Nondetect:	0.0	0.0	100.0	0.0	0.0	80.0	0.0
Mean:	4.605	9.160	NA	28.950	15.150	NA	2.680
Std Deviation:	0.414	1.124	NA	4.407	1.785	NA	0.344
95% UCL:	**5.43**	**11.41**	NA	**37.76**	**18.72**	NA	**3.37**
Nonparametric Limit:	NA	NA	**LOQ**	NA	NA	**0.96**	NA

Notes:

Bold nondetect results have had one-half the detection limit substituted in the confidence limit calculations.

The 95% upper confidence limit (UCL) is equal to the mean plus 2 times the standard deviation.

A 95% upper confidence limit was calculated for each data set having 50% or fewer nondetect values.

A nonparametric limit was determined for each data set having between 50% and 100% nondetect values.

The LOQ is the "background limit" for each data set having 100% nondetect values.

BACKGROUND UPPER 95% CONFIDENCE LIMIT CALCULATIONS
LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES

DATE	SENTINEL WELL RM-210I						
	TCE	**1,2-DCE**	**VC**	**111-TCA**	**11-DCA**	**CEA**	**11-DCE**
19-Mar-01	2.6	5.3	< 0.17	19	8.3	< 0.63	0.65
26-Jun-01	2.6	5.2	< 0.17	19	9	< 0.63	1
1-Oct-01	2.5	4.6	< 0.17	17	7.8	< 0.63	0.91
4-Dec-01	2.7	5	< 0.17	18	8.5	< 0.63	1.4
27-Mar-02	2.9	5.6	< 0.17	22	9.7	< 0.63	1.1
19-Jul-02	2	4	< 0.17	13	7.7	< 0.63	1.1
24-Sep-02	2.7	5	< 0.11	19	7.8	< 0.84	0.79
12-Dec-02	3	4.5	< 0.11	18	8	< 0.84	< **0.28**
25-Mar-03	2.8	4.3	< 0.18	17	6.7	< 0.97	1
24-Jul-03	2.5	4.5	< 0.18	17	6.5	< 0.97	0.61
23-Sep-03	2.3	3.5	< 0.18	15	6.1	< 0.97	0.94
3-Dec-03	2.4	4.2	< 0.18	16	6.8	< 0.97	1.1
28-Sep-04	2.2	4.7	< 0.18	18	< **0.11**	< 0.28	< **0.135**
30-Nov-04	2	3.9	< 0.18	13	6.3	< 0.97	1.1
18-Apr-05	2.1	3.7	< 0.18	14	6.1	< 0.97	0.61
30-Nov-05	2.6	4	< 0.18	16	6.6	< 0.97	1.2
11-Jul-06	2.2	3.4	< 0.18	13	5.4	< 0.97	1.1
# Observations:	17	17	17	17	17	17	17
% Nondetect:	0.0	0.0	100.0	0.0	5.9	100.0	11.8
Mean:	2.476	4.435	NA	16.706	6.906	NA	0.884
Std Deviation:	0.305	0.645	NA	2.519	2.100	NA	0.333
95% UCL:	**3.09**	**5.73**	NA	**21.74**	**11.11**	NA	**1.55**
Nonparametric Limit:	NA	NA	**LOQ**	NA	NA	**LOQ**	NA

Notes:

Bold nondetect results have had one-half the detection limit substituted in the confidence limit calculations.

The 95% upper confidence limit (UCL) is equal to the mean plus 2 times the standard deviation.

A 95% upper confidence limit was calculated for each data set having 50% or fewer nondetect values.

A nonparametric limit was determined for each data set having between 50% and 100% nondetect values.

The LOQ is the "background limit" for each data set having 100% nondetect values.

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BACKGROUND UPPER 95% CONFIDENCE LIMIT CALCULATIONS
LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES

	SENTINEL WELL RM-211D						
DATE	**TCE**	**1,2-DCE**	**VC**	**111-TCA**	**11-DCA**	**CEA**	**11-DCE**
14-Mar-01	< 0.49	< 0.9	< 0.17	0.57	< **0.305**	< 0.63	< 0.47
22-Jun-01	< 0.49	< 0.9	< 0.17	1.3	0.69	< 0.63	< 0.47
4-Sep-01	< 0.49	< 0.9	< 0.17	1.8	0.86	< 0.63	< 0.47
3-Dec-01	0.61	< 0.9	< 0.17	1.4	0.63	< 0.63	< 0.47
16-Mar-02	< 0.49	< 0.9	< 0.17	< **0.265**	< **0.305**	< 0.63	< 0.47
6-Jul-02	< 0.49	< 0.9	< 0.17	2.6	2	< 0.63	< 0.47
1-Oct-02	< 0.39	< 1.2	< 0.11	1	< **0.435**	< 0.84	< 0.56
11-Dec-02	< 0.39	< 1.2	< 0.11	< **0.325**	< **0.435**	< 0.84	< 0.56
12-Mar-03	< 0.39	< 1.2	< 0.11	< **0.325**	< **0.435**	< 0.84	< 0.56
6-Jul-03	< 0.48	< 1.4	< 0.18	< **0.45**	< **0.375**	< 0.97	< 0.57
17-Sep-03	< 0.48	< 1.4	< 0.18	< **0.45**	< **0.375**	< 0.97	< 0.57
4-Dec-03	< 0.48	< 1.4	< 0.18	< **0.45**	< **0.375**	< 0.97	< 0.57
27-Sep-04	< 0.18	< 0.26	< 0.18	< **0.11**	0.66	< 0.28	< 0.27
18-Apr-05	< 0.48	< 1.4	< 0.18	< **0.45**	< **0.375**	< 0.97	< 0.57
13-Jul-06	< 0.48	< 1.4	< 0.18	< **0.45**	< **0.375**	< 0.97	< 0.57
# Observations:	15	15	15	15	15	15	15
% Nondetect:	93.3	100.0	100.0	60.0	66.7	100.0	100.0
Mean:	NA	NA	NA	NA	NA	NA	NA
Std Deviation:	NA	NA	NA	NA	NA	NA	NA
95% UCL:	NA	NA	NA	NA	NA	NA	NA
Nonparametric Limit:	**0.61**	**LOQ**	**LOQ**	**2.6**	**2.0**	**LOQ**	**LOQ**

Notes:

Bold nondetect results have had one-half the detection limit substituted in the confidence limit calculations.

The 95% upper confidence limit (UCL) is equal to the mean plus 2 times the standard deviation.

A 95% upper confidence limit was calculated for each data set having 50% or fewer nondetect values.

A nonparametric limit was determined for each data set having between 50% and 100% nondetect values.

The LOQ is the "background limit" for each data set having 100% nondetect values.

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Appendix H
Residential Well Construction Logs

Table 9
Summary of Private Well Construction Information
Lemberger Landfill and Lemberger Transport and Recycling Site
Town of Franklin, Manitowoc County, Wisconsin

Well Designation	Wisconsin Unique Well Number(s)	Casing Depth (ft)	Total Depth (ft)	Construction Mo-Yr	Street Address of Well Location	Owner	Resident	Name on Well Constructor's Report	Notes
GR-8	BK413	250	262	Apr-1986	7504 Taus Road	Richard Eiles	same	Tom Hanly	BK349 also assigned
GR-9	BK415	250	342	Nov-1985	7435 Taus Road	Harlan Saur	none	Edwin Saur	
	BK350	*not known*	*40*	*not known*	*Rt 1, Box 302 (Whitelaw)*	*Edwin Saur*		*no log*	*assumed to be abandoned*
GR-10	EZ331	250	480	not known	7321 Taus Road	Jeff Wilker	same	no log	
GR-11	BK416	253	362	Apr-1986	7208 Taus Road	Jane Kalies	same	Jane Kalies	
	BK364	*59*	*87*	*Jan-1967*	*Rt 1, Box 302A (Whitelaw)*	*Jane Kalies*		*Douglas Kalies*	*assumed to be abandoned*
GR-12	CW004	252	318	Sep-1985	13116 Reifs Mills Road	John Dugan	same	John Dugan	
	BK355	*not known*	*86*	*not known*	*Rt 1 (Whitelaw)*	*John Dugan*		*no log*	*assumed to be abandoned*
GR-13	BK381	not known	not known	not known	13207 Reifs Mills Road	Emily Kubicka	same	no log	
GR-14	BK363	43	45	Jul-1981	13416 Reifs Mills Road	Rosemary Schneider	same	Donald Schneider	
GR-15	BK409	not known	not known	not known	13323 Reifs Mills Road	Chad Olm	same	no log	
GR-16	BK371	not known	not known	not known	6512 River Bend Road	Karl Schultz	same	no log	BK371 assigned to GR-16, although the address and owner (13535 River Bend Road, Dale Novak) do not match, 13535 not a valid address
GR-17	BK410	250	318	Nov-1985	12933 Reifs Mills Road	Wayne Menza	same	Wayne Menza	
	BK354	*not known*	*50*	*not known*	*Rt 1 (Whitelaw)*	*Wayne Menza*		*no log*	*assumed to be abandoned*
GR-24	BK366	42	182	Aug-1982	12330 Sunny Slope Road	Waste Management, Inc.	n/a	Norbert Braun	
GR-25	BK365	not known	not known	not known	5925 Hempton Lake Road	Edward Baroun	same	no log	
GR-26	AO649	210	256	Mar-1982	13116 Sunny Slope Road	Kenney Lemberger	none	Ken Lemberger	BK377 and AP022 also assigned
GR-27	BK353	not known	not known	not known	6203 Ledvina Road	Rose Mary Ledvina	same	no log	
GR-30	BK414	252	342	Mar-1986	5330 Hempton Lake Road	Terry Lemberger	Casey Lemberger	Alice Lemberger	
	BK383	*not known*	*120*	*not known*	*Rt 1 Hempton Lake Rd (Whitelaw)*	*Alice Lemberger*		*no log*	*assumed to be abandoned*
GR-31	BK376	40	163	May-1970	12504 Palm Grove Road	Ervin Polifka	same	Ervin Polifka	
GR-33	BK375	not known	not known	not known	4833 Mayerl Road	Richard Lodel	same	no log	
GR-41	BK391	not known	not known	not known	12435 Palm Grove Road	Tom Ebert	same	no log	
GR-60R	IG758	252	361	Jun-1994	13418 Sunny Slope Road	Michael Golen	none	Leo Denor	AP022 also assigned
GR-62	HL794	250	322	Oct-1993	7325 Taus Road	Carl Franz	same	Tony Franz	
GR-63	DS921	252	320	Mar-1992	12820 Reifs Mills Road	James Einburger	same	Jim Einberger	
GR-64	IE118	250	380	Apr-1995	12815 Reifs Mills Road	Per Engstrom	same	Floyd Lonzo	
GR-65	LK291	253	360	Dec-1996	6726 River Bend Road	Corliss & Diana Prindle	same	Corliss Prindle	log lists address of 13535C Riefs Mills Road, 13535 not a valid address

8

State of Wisconsin
Department of Natural Resources
Private Water Supply
Box 7921
Madison, Wisconsin 53707

NOTE:
White Copy – Division's Copy
Green Copy – Driller's Copy
Yellow Copy – Owner's Copy

WELL CONSTRUCTOR'S REPORT

Form 3300-15 Rev. 5-85

APR 23 1986

1. COUNTY: Manitowoc
CHECK (✓) ONE: [X] Town [ ] Village [ ] City — Name: Franklin

2. LOCATION: ¼ Section or Gov't. Lot ✓: ~~NW¼ NE¼~~ / NW SE — Section: 22 — Township: 20N — Range: 22E
OR – Grid or Street No. — Street or Road Name
AND – If available subdivision name, lot & block No.

3. NAME: [X] OWNER [ ] AGENT AT TIME OF DRILLING CHECK (✓) ONE
Tom Hanly
ADDRESS: R. 1
POST OFFICE: Whitelaw, Wis. — ZIP CODE: 54247

4. Distance in feet from well to nearest: (Record answer in appropriate block)

Building	Sanitary Bldg. Drain C.I.	Sanitary Bldg. Drain Other	Sanitary Bldg. Sewer C.I.	Sanitary Bldg. Sewer Other	Floor Drain Connected To: C.I. Sewer	Floor Drain Connected To: Other Sewer	Storm Bldg. Drain C.I.	Storm Bldg. Drain Other	Storm Bldg. Sewer C.I.	Storm Bldg. Sewer Other
12	–	–	–	–	–	–	–	–	–	–

Street Sewer San.	Street Sewer Storm	Other Sewers C.I.	Other Sewers Other	Foundation Drain Connected to: Sewer / Clearwater Dr. / Sewage Sump / Clearwater Sump	Sewage Sump C.I.	Sewage Sump Other	Clearwater Sump	Septic Tank	Holding Tank	Sewage Absorption Unit: Seepage Pit / Seepage Bed / Seepage Trench	Manure Hopper or Retention or Pnuematic Tank
–	–	–	–		–	–	–	70	–	Seepage Bed 150	–

Privy	Pet Waste Pit	Pit: Nonconforming Existing (Well / Pump / Tank)	Subsurface Pumproom Nonconforming Existing	Barn Gutter	Animal Barn Pen	Animal Yard	Silo With Pit	Glass Lined Storage Facility	Silo w/o Pit	Earthen Silage Storage Trench Or Pit	Earthen Manure Basin
–	–	–	–	–	–	–	–	–	–	–	–

Temporary Manure Stack or Platform	Watertight Liquid Manure Tank or Basin	Manure Pressure Pipe	Subsurface Gasoline or Oil Tank	Waste Pond or Land Disposal Unit (Specify Type)	Manure Storage Basin: Concrete Floor Only / Concrete Floor and Partial Concrete Walls	Other (Describe)
–	–	–	–	–		–

5. Well is intended to supply water for: Home

6. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
10	Surface	250	6	250	262

7. CASING, LINER, CURBING AND SCREEN

Dia. (in.)	Material, Weight, Specification Mfg. & Method of Assembly	From (ft.)	To (ft.)
6	ASTM A-120	Surface	250
	Union Steel		
	Welded joint		
	Wt. 18.97 per ft.		

8. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Cement	Surface	250

9. FORMATIONS

Kind	From (ft.)	To (ft.)
clay	Surface	10
clay & gravel	10	35
gravel & broken rock	35	45
limestone	45	262

10. TYPE OF DRILLING MACHINE USED
[ ] Cable Tool [X] Rotary-hammer w/drilling mud & air [ ] Jetting with [ ] Air [ ] Water
[ ] Rotary-air w/drilling mud [ ] Rotary-hammer & air
[ ] Rotary-w/drilling mud [ ] Reverse Rotary

Well construction completed on April 9, 1986
Well is terminated 8 inches [X] above [ ] below final grade
Well disinfected upon completion [X] Yes [ ] No
Well sealed watertight upon completion [X] Yes [ ] No

11. MISCELLANEOUS DATA
Yield Test: 4 Hrs. at 30 GPM
Depth from surface to normal water level 4 Ft.
Depth of water level when pumping 4 Ft. Stabilized [X] Yes [ ] No

Water sample sent to Madison laboratory on April 9, 1986

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, method of finishing the well, amount of cement used in grouting, blasting, etc., should be given on reverse side.

Signature: Leonard J. Willems — Registered Well Driller

Business Name and Complete Mailing Address:
Tipler Well Drilling
R. 1 Greenleaf, Wis. 54126

701

2

Source: GRN NO DETAIL BN413

Department Of Natural Resources, Box 7921 Madison, WI 53707 (Rev 02/02)bw Y

Depth FT

Property Owner THOMAS HANLEY Telephone Number 920-732-3963

Mailing Address ROUTE 1 BOX 301A

City WHITELAW State WI Zip Code 54247

County of Well Location 36 MANITOWOC Co Well Permit No W Well Completion Date

Well Constructor License # Facility ID (Public)

Address Public Well Plan Approval#

City State Zip Code Date Of Approval

Hicap Permanent Well # Common Well # GR-08 Specific Capacity gpm/ft

1. Well Location
T=Town C=City V=Village of Fire#

Street Address or Road Name and Number

Subdivision Name Lot# Block #

Gov't Lot or NW 1/4 of SE 1/4 of Section 22 T 20 N;R 22 E

Latitude Deg. Min.
Longitude Deg Min.

2. Well Type (See item 12 below) Lat/Long Method
1=New 2=Replacement 3=Reconstruction
of previous unique well # __________ constructed in ______
Reason for replaced or reconstructed Well?
1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves # of homes and or PR (eg: barn, restaurant, church, school, industry, etc.) High Capacity: Well? Property?
M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties?
Well located in floodplain?
Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
	surface	

Upper Enlarged Drillhole Lower Open Bedrock
-- 1. Rotary - Mud Circulation
-- 2. Rotary - Air
-- 3. Rotary - Air and Foam
-- 4. Drill-Through Casing Hammer
-- 5. Reverse Rotary
-- 6. Cable-tool Bit _ n. dia
-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?
Other

8. Geology

Geology Codes	Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
		surface	

Dia.(in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
	surface		

9. Static Water Level
feet ground surface A=Above B=Below

10. Pump Test
Pumping level ft. below surface
Pumping at GP Hrs

11. Well Is: in. Grade A=Above B=Below
Developed?
Disinfected?
Capped?

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property?
If no, explain

13. Initials of Well Constructor or Supervisory Driller Date Signed

Initials of Drill Rig Operator (Mandatory unless same as above) Date Signed

Additonal Comments? Variance Issued?
Owner Sent Label? More Geology?

Batch GRN - NO

3

Source: GRN NO DETAIL   BK549

Department Of Natural Resources, Box 7921
Madison, WI 53707   (Rev 02/02)bw

Property Owner: THOMAS HANLEY   Telephone Number: 920-732-3963
Mailing Address: RT 1 BOX 301A
City: WHITELAW   State: WI   Zip Code: 54247
County of Well Location: 36 MANITOWOC   Co Well Permit No: W   Well Completion Date:

Depth   FT

1. Well Location
T=Town C=City V=Village of   Fire#
Street Address or Road Name and Number
Subdivision Name   Lot#   Block #
Gov't Lot or NW 1/4 of SE 1/4 of Section 22 T 20 N;R 22 E
Latitude Deg. Min.
Longitude Deg Min.
Lat/Long Method

Well Constructor   License #   Facility ID (Public) 036002230
Address   Public Well Plan Approval#
City   State   Zip Code   Date Of Approval
Hicap Permanent Well #   Common Well #   Specific Capacity gpm/ft

2. Well Type (See item 12 below)
1=New 2=Replacement 3=Reconstruction
of previous unique well # ______ constructed in ______
Reason for replaced or reconstructed Well?
1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves # of homes and or (eg: barn, restaurant, church, school, industry, etc.)
M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole
High Capacity: Well? Property?

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties?
Well located in floodplain?
Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
	surface	

Upper Enlarged Drillhole   Lower Open Bedrock
-- 1. Rotary - Mud Circulation
-- 2. Rotary - Air
-- 3. Rotary - Air and Foam
-- 4. Drill-Through Casing Hammer
-- 5. Reverse Rotary
-- 6. Cable-tool Bit _ in. dia
-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?
Other

8. Geology

Geology Codes	Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
		surface	

Dia.(in.)	Screen type, material & slot size	From	To

9. Static Water Level
feet   ground surface   A=Above B=Below

10. Pump Test
Pumping level   ft. below surface
Pumping at   GP   Hrs

11. Well Is: in.   Grade   A=Above B=Below
Developed?
Disinfected?
Capped?

7. Grout or Other Sealing Material

Method Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
	surface		

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property?
If no, explain

13. Initials of Well Constructor or Supervisory Driller   Date Signed
Initials of Drill Rig Operator (Mandatory unless same as above)   Date Signed

Additonal Comments?   Variance Issued?
Owner Sent Label?   More Geology?

Batch GRN - NO

4

9

State of Wisconsin
Department of Natural Resources
Private Water Supply
Box 7921
Madison, Wisconsin 53707

NOTE:
White Copy – Division's Copy
Green Copy – Driller's Copy
Yellow Copy – Owner's Copy

WELL CONSTRUCTOR'S REPORT

Form 3300-15 Rev. 5-85

APR 2 3 1986

1. COUNTY: Manitowoc
CHECK (✓) ONE: [X] Town [ ] Village [ ] City — Name: Franklin

2. LOCATION: ¼ Section or Gov't. Lot: NW¼ SE¼ — Section: 22 — Township: 20N — Range: 22E
OR – Grid or Street No. — Street or Road Name
AND – If available subdivision name, lot & block No.

3. NAME: [X] OWNER [ ] AGENT AT TIME OF DRILLING CHECK (✓) ONE
Edwin Sauer
ADDRESS: R. 1
POST OFFICE: Whitelaw, Wis. — ZIP CODE: 54247

4. Distance in feet from well to nearest: (Record answer in appropriate block)

Building	Sanitary Bldg. Drain C.I.	Sanitary Bldg. Drain Other	Sanitary Bldg. Sewer C.I.	Sanitary Bldg. Sewer Other	Floor Drain Connected To: C.I. Sewer	Floor Drain Connected To: Other Sewer	Storm Bldg. Drain C.I.	Storm Bldg. Drain Other	Storm Bldg. Sewer C.I.	Storm Bldg. Sewer Other
6	–	–	–	–	–	–	–	–	–	–

Street Sewer San.	Street Sewer Storm	Other Sewers C.I.	Other Sewers Other	Foundation Drain Connected to: Sewer / Clearwater Dr.	Foundation Drain Connected to: Sewage Sump / Clearwater Sump	Sewage Sump C.I.	Sewage Sump Other	Clearwater Sump	Septic Tank	Holding Tank	Sewage Absorption Unit (Seepage Pit / Seepage Bed / Seepage Trench)	Manure Hopper or Retention or Pnuematic Tank
–	–	–	–			–	–	–	75	–	Seepage Bed: 100	–

Privy	Pet Waste Pit	Pit: Nonconforming Existing (Well / Pump / Tank)	Subsurface Pumproom Nonconforming Existing	Barn Gutter	Animal Barn Pen	Animal Yard	Silo With Pit	Glass Lined Storage Facility	Silo w/o Pit	Earthen Silage Storage Trench Or Pit	Earthen Manure Basin
–	–	–	–	–	–	–		–	–	–	–

Temporary Manure Stack or Platform	Watertight Liquid Manure Tank or Basin	Manure Pressure Pipe	Subsurface Gasoline or Oil Tank	Waste Pond or Land Disposal Unit (Specify Type)	Manure Storage Basin (Concrete Floor Only / Concrete Floor and Partial Concrete Walls)	Other (Describe)
–	–	–	–	–		See WD file Re variance to chicken pen

5. Well is intended to supply water for: Home

6. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
10	Surface	250	6	250	342

7. CASING, LINER, CURBING AND SCREEN

Dia. (in.)	Material, Weight, Specification Mfg. & Method of Assembly	From (ft.)	To (ft.)
6	ASTM A-120	Surface	250
	Union Steel		
	Welded joint		
	Wt. 18.97 per ft.		

8. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Cement	Surface	250

9. FORMATIONS

Kind	From (ft.)	To (ft.)
clay & boulders	Surface	10
clay	10	46
broken rock & gravel	46	56
limestone	56	342

10. TYPE OF DRILLING MACHINE USED
[ ] Cable Tool
[ ] Rotary-air w/drilling mud
[ ] Rotary-w/drilling mud
[X] Rotary-hammer w/drilling mud & air
[ ] Rotary-hammer & air
[ ] Reverse Rotary
[ ] Jetting with [ ] Air [ ] Water

Well construction completed on November 7, 1985

Well is terminated 8 inches [X] above [ ] below final grade

Well disinfected upon completion [X] Yes [ ] No

Well sealed watertight upon completion [X] Yes [ ] No

11. MISCELLANEOUS DATA
Yield Test: 4 Hrs. at 10 GPM
Depth from surface to normal water level 20 Ft.
Depth of water level when pumping 20 Ft. Stabilized [X] Yes [ ] No

Water sample sent to Madison laboratory on April 9, 1986

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, method of finishing the well, amount of cement used in grouting, blasting, etc., should be given on reverse side.

Signature: Leonard J. Willems — Registered Well Driller

Business Name and Complete Mailing Address:
Tipler Well Drilling
R. 1 Greenleaf, Wis. 54126

702

5

Source: GRN NO DETAIL

BK415

Department Of Natural Resources, Box 7921
Madison, WI 53707

(Rev 02/02)bw

Depth FT

Property Owner: EDWIN SAUER
Telephone Number: 920-732-4497
Mailing Address: ROUTE 1 BOX 302
City: WHITELAW State: WI Zip Code: 54247
County of Well Location: 36 MANITOWOC
Co Well Permit No: W
Well Completion Date

1. Well Location
T=Town C=City V=Village
T of FRANKLIN
Fire#
Street Address or Road Name and Number
Subdivision Name | Lot# | Block #
Gov't Lot or NW 1/4 of SE 1/4 of Section 22 T 20 N;R 22 E
Latitude Deg. Min.
Longitude Deg Min.
Lat/Long Method

Well Constructor License # | Facility ID (Public)
Address | Public Well Plan Approval#
City State Zip Code | Date Of Approval
Hicap Permanent Well # | Common Well # GR-09 | Specific Capacity gpm/ft

2. Well Type (See item 12 below)
1=New 2=Replacement 3=Reconstruction
of previous unique well # ______ constructed in ______
Reason for replaced or reconstructed Well?
1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves # of homes and or
PR (eg: barn, restaurant, church, school, industry, etc.)
M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole
High Capacity: Well? Property?

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties?
Well located in floodplain?
Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
	surface	

Upper Enlarged Drillhole / Lower Open Bedrock
-- 1. Rotary - Mud Circulation
-- 2. Rotary - Air
-- 3. Rotary - Air and Foam
-- 4. Drill-Through Casing Hammer
-- 5. Reverse Rotary
-- 6. Cable-tool Bit _ in. dia
-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?
Other

8. Geology

Geology Codes	Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
		surface	

Dia.(in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
	surface		

9. Static Water Level
feet ground surface
A=Above B=Below

10. Pump Test
Pumping level ft. below surface
Pumping at GP Hrs

11. Well Is: in. Grade
A=Above B=Below
Developed?
Disinfected?
Capped?

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property?
If no, explain

13. Initials of Well Constructor or Supervisory Driller Date Signed

Initials of Drill Rig Operator (Mandatory unless same as above) Date Signed

Additonal Comments? Variance Issued?
Owner Sent Label? More Geology?

Batch GRN - NO

6

Source: GRN NO DETAIL

BK550

Department Of Natural Resources, Box 7921
Madison, WI 53707

(Rev 02/02)bw

Depth 40 FT

Property Owner: EDWIN SAUER
Telephone Number: 920 -732 -4497
Mailing Address: RT 1 BOX 302
City: WHITELAW
State: WI
Zip Code: 54247
County of Well Location: 36 MANITOWOC
Co Well Permit No: W
Well Completion Date

Well Constructor
License #
Facility ID (Public): 036002340
Address
Public Well Plan Approval#
City State Zip Code
Date Of Approval
Hicap Permanent Well #
Common Well #
Specific Capacity gpm/ft

1. Well Location
T=Town C=City V=Village of
Fire#
Street Address or Road Name and Number
Subdivision Name
Lot#
Block #
Gov't Lot or NW 1/4 of SE 1/4 of Section 22 T 20 N;R 22 E
Latitude Deg. Min.
Longitude Deg Min.

2. Well Type (See item 12 below)
Lat/Long Method
1=New 2=Replacement 3=Reconstruction
of previous unique well # __________ constructed in ______
Reason for replaced or reconstructed Well?
1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves # of homes and or
(eg: barn, restaurant, church, school, industry, etc.)
M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole
High Capacity: Well?
Property?

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties?
Well located in floodplain?
Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain
1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure
1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure
1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
	surface	

Upper Enlarged Drillhole / Lower Open Bedrock
-- 1. Rotary - Mud Circulation
-- 2. Rotary - Air
-- 3. Rotary - Air and Foam
-- 4. Drill-Through Casing Hammer
-- 5. Reverse Rotary
-- 6. Cable-tool Bit _ n. dia
-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?
Other

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
		surface	

Dia.(in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method / Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
	surface		

8.

Geology Codes	Geology Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)

9. Static Water Level
feet ground surface
A=Above B=Below

10. Pump Test
Pumping level ft. below surface
Pumping at GP Hrs

11. Well Is: in. Grade
A=Above B=Below
Developed?
Disinfected?
Capped?

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property?
If no, explain

13. Initials of Well Constructor or Supervisory Driller
Date Signed
Initials of Drill Rig Operator (Mandatory unless same as above)
Date Signed

Additonal Comments?
Owner Sent Label?
Variance Issued?
More Geology?

Batch GRN - NO

7

WISCONSIN UNIQUE WELL NUMBER EZ331

Source: GRN NO DETAIL

Department Of Natural Resources, Box 7921
Madison, WI 53707

(Rev 02/02)bw

Depth 480 FT

Property Owner: HANS ROSE
Telephone Number: 920-893-8755
Mailing Address: RT 1 BOX 50 HWY E

City	State	Zip Code
PLYMOUTH	WI	53073

County of Well Location	Co Well Permit No	Well Completion Date
36 MANITOWOC	W	September 25, 1987

Well Constructor: WEBER W.D. License #
Facility ID (Public)
Address
Public Well Plan Approval#
City State Zip Code
Date Of Approval
Hicap Permanent Well # Common Well #
Specific Capacity gpm/ft

1. Well Location
T=Town C=City V=Village of
Fire#
Street Address or Road Name and Number: 7231 TAUS RD
Subdivision Name Lot# Block #
Gov't Lot or SE 1/4 of SE 1/4 of Section 22 T 20 N;R 22 E
Latitude Deg. Min.
Longitude Deg Min.
Lat/Long Method

2. Well Type (See item 12 below)
1=New 2=Replacement 3=Reconstruction
of previous unique well # ________ constructed in ______
Reason for replaced or reconstructed Well?
1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves # of homes and or
(eg: barn, restaurant, church, school, industry, etc.)
M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole
High Capacity: Well? Property?

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties?
Well located in floodplain?
Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain
    1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure
    1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure
    1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
	surface	

Upper Enlarged Drillhole / Lower Open Bedrock
- 1. Rotary - Mud Circulation
- 2. Rotary - Air
- 3. Rotary - Air and Foam
- 4. Drill-Through Casing Hammer
- 5. Reverse Rotary
- 6. Cable-tool Bit _ n. dia
- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?

Other

8. Geology

Geology Codes	Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
6.0		surface	250

Dia.(in.)	Screen type, material & slot size	From	To

9. Static Water Level
35.0 feet ground surface
A=Above B=Below

10. Pump Test
Pumping level ft. below surface
Pumping at GP Hrs

11. Well Is: in. Grade
A=Above B=Below
Developed?
Disinfected?
Capped?

7. Grout or Other Sealing Material

Method / Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
	surface		

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property?
If no, explain

13. Initials of Well Constructor or Supervisory Driller Date Signed

Initials of Drill Rig Operator (Mandatory unless same as above) Date Signed

Additonal Comments? Variance Issued?
Owner Sent Label? More Geology?

Batch GRN - NO

8

11

State of Wisconsin
Department of Natural Resources
Private Water Supply
Box 7921
Madison, Wisconsin 53707

NOTE:
White Copy – Division's Copy
Green Copy – Driller's Copy
Yellow Copy – Owner's Copy

WELL CONSTRUCTOR'S REPORT
Form 3300–15 Rev. 5-85

JUL 10 1986

1. COUNTY Manitowoc
CHECK (✓) ONE: XX Town ☐ Village ☐ City — Name Franklin

2. LOCATION NE ¼ Section or Gov't. Lot SW¼ SE¼ — Section 22 — Township 20N — Range 22E
OR – Grid or Street No. — Street or Road Name
AND – If available subdivision name, lot & block No.

3. NAME ☒ OWNER ☐ AGENT AT TIME OF DRILLING CHECK (✓) ONE
Jane Kalies
ADDRESS R. 1
POST OFFICE Whitelaw, Wis. — ZIP CODE 54247

4. Distance in feet from well to nearest: (Record answer in appropriate block)

Building	Sanitary Bldg. Drain C.I.	Sanitary Bldg. Drain Other	Sanitary Bldg. Sewer C.I.	Sanitary Bldg. Sewer Other	Floor Drain Connected To: C.I. Sewer	Floor Drain Connected To: Other Sewer	Storm Bldg. Drain C.I.	Storm Bldg. Drain Other	Storm Bldg. Sewer C.I.	Storm Bldg. Sewer Other
–	–	–	–	–	–	–	–	–	–	–

Street Sewer San.	Street Sewer Storm	Other Sewers C.I.	Other Sewers Other	Foundation Drain Connected to: Sewer / Clearwater Dr. / Sewage Sump / Clearwater Sump	Sewage Sump C.I.	Sewage Sump Other	Clearwater Sump	Septic Tank	Holding Tank	Sewage Absorption Unit: Seepage Pit / Seepage Bed / Seepage Trench	Manure Hopper or Retention or Pnuematic Tank
–	–	–	–		–	–	–	75	–	Seepage Bed 100	–

Privy	Pet Waste Pit	Pit: Nonconforming Existing Well / Pump / Tank	Subsurface Pumproom Nonconforming Existing	Barn Gutter	Animal Barn Pen	Animal Yard	Silo With Pit	Glass Lined Storage Facility	Silo w/o Pit	Earthen Silage Storage Trench Or Pit	Earthen Manure Basin
–	–		–	–	–	–	–	–	–	–	–

Temporary Manure Stack or Platform	Watertight Liquid Manure Tank or Basin	Manure Pressure Pipe	Subsurface Gasoline or Oil Tank	Waste Pond or Land Disposal Unit (Specify Type)	Manure Storage Basin: Concrete Floor Only / Concrete Floor and Partial Concrete Walls	Other (Describe)
–	–	–	–	–		–

5. Well is intended to supply water for: Home

6. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
10	Surface	253	6	253	362

7. CASING, LINER, CURBING AND SCREEN

Dia. (in.)	Material, Weight, Specification Mfg. & Method of Assembly	From (ft.)	To (ft.)
6	ASTM A-53	Surface	253
	Dong Bu		
	Welded joint		
	Wt. 18.97 per ft.		

8. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Cement	Surface	253

9. FORMATIONS

Kind	From (ft.)	To (ft.)
clay & boulders	Surface	30
boulders	30	42
hard pan	42	63
limestone	63	362

10. TYPE OF DRILLING MACHINE USED
☐ Cable Tool ☐ Rotary-air w/drilling mud ☐ Rotary-w/drilling mud ☒ Rotary-hammer w/drilling mud & air ☐ Rotary-hammer & air ☐ Reverse Rotary ☐ Jetting with ☐ Air ☐ Water

Well construction completed on April 22, 1986

Well is terminated 8 inches ☒ above ☐ below final grade

Well disinfected upon completion ☒ Yes ☐ No

Well sealed watertight upon completion ☒ Yes ☐ No

11. MISCELLANEOUS DATA
Yield Test: 4 Hrs. at 40 GPM
Depth from surface to normal water level 20 Ft.
Depth of water level when pumping 20 Ft. Stabilized ☒ Yes ☐ No
Water sample sent to Madison laboratory on May 8, 1986

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, method of finishing the well, amount of cement used in grouting, blasting, etc., should be given on reverse side.

Signature Leonard J. Willems — Registered Well Driller
699

Business Name and Complete Mailing Address
Willems Well Drilling
R. 1 Greenleaf, Wis. 54126

plot 9

Source: GRN NO DETAIL BK416

Department Of Natural Resources, Box 7921 Madison, WI 53707 (Rev 02/02)bw

Depth FT

Property Owner	JANE KALIES
Telephone Number	920-732-3462
Mailing Address	7208 TAUS RD
City	WHITELAW
State	WI
Zip Code	54247
County of Well Location	36 MANITOWOC
Co Well Permit No	W
Well Completion Date	
Well Constructor	
License #	
Facility ID (Public)	
Address	
Public Well Plan Approval#	
City / State / Zip Code	
Date Of Approval	
Hicap Permanent Well #	
Common Well #	GR-11
Specific Capacity	gpm/ft

1. Well Location
T=Town C=City V=Village of
Fire#
Street Address or Road Name and Number
Subdivision Name | Lot# | Block #
Gov't Lot or SW 1/4 of SE 1/4 of Section 22 T 20 N;R 22 E
Latitude Deg. Min.
Longitude Deg Min.
Lat/Long Method

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		surface	

Dia.(in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method / Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
	surface		

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feet ground surface A=Above B=Below

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Pumping at GP Hrs

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Owner Sent Label? More Geology?

Batch GRN - NO

10